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FINAL REPORT

REPORT MSSA01-001

REV. 0

MARINE SEISMIC SYSTEM DEPLOYMENT (MSS) PHASE III

Investigation of techniques and deployment scenarios for installation of triaxial seismometer in a borehole in the deep ocean.

Robert L. Wallerstedt
GLOBAL MARINE DEVELOPMENT INC
2302 Martin Street
Irvine, California 92715

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SECTION 1.0 - SUMMARY

Phase III of MSS Deployment Program was successfully completed with the finalization of the design for MSS '82 Deployment Configuration I reentry assembly. Operational and mobilization planning for the projected MSS '82 activities in the North Pacific were initiated. Mobilization will be tentatively accomplished in Hakodate, Japan, in conjunction with the DSDP Glomar Challenger. Actual At-Sea deployment and test operations are to be conducted in late August and early September 1982. A special NORDA encased borehole and reentry cone will be emplaced, and a Borehole Instrumentation Package (BIP) will then be deployed along with a Bottom Processing Package (BPP).

Earlier in the year, the initial very successful MSS '81 At-Sea-Test of the deployment and seismic equipment was accomplished demonstrating basic system feasibility. The At-Sea-Test was conducted utilizing the DSDP Glomar Challenger and USNS Lynch. The early model BIP seismic package was deployed by the Glomar Challenger on the end of the drill string into the existing DSDP Site 395A borehole located in the mid-North Atlantic at a water depth of 4,484 meters (14,712 ft). Reentry and lowering the BIP 609m into the borehole were all successfully undertaken. Approximately 26 hours of seismic data recording was achieved using the USNS Lynch to drop explosive charges. The BIP was subsequently recovered with no damage. The overall At-Sea operation required approximately 3 days to accomplish. The MSS '81 At-Sea-Test has been reported on in detail by separate report (Reference 2).

On a limited basis, conceptual planning for a MSS "Fly-In" deployment in 1984 was initiated. Several positioning and control concepts were evaluated. A simple in-house computer program was being established to evaluate basic "Fly-In" maneuvering characteristics and conceptual options. The use of a subsea deployment platform supported by a towed cable and positioned by surface vessel maneuvering appears to be the optimum approach. Various control and positioning options were evaluated.

Covered in this report is a summary of the 1981 At-Sea-Test operations, a description of the Configuration I design, a preliminary planning for MSS '82 test, a discussion of the alternate "Fly-In" deployment status, an overall program plan, plus a MSS deployment program cost projection.

SECTION 2.0 - INTRODUCTION

The Marine Seismic System (MSS) is a DARPA sponsored program to develop reentry and deployment equipment which is capable of installing a seismic Borehole Instrumentation Package (BIP) and its associated support equipment into the ocean bottom basalt layer in water depths up to 6,096 meters (20,000 feet). A deep borehole will be drilled and cased through the sediment into the basalt layer, utilizing standard deep ocean drilling techniques developed under the direction of the Deep Sea Drilling Project (DSDP) by the dynamically positioned drilling vessel Glomar Challenger. Baseline deployment of the BIP into the borehole will be accomplished utilizing a procedure wherein a reentry sub is lowered to near the ocean floor with the drill string and stabbed into the borehole reentry cone. This reentry sub incorporates a sonar tool which is used to guide into the borehole. The baseline BIP reentry concept modifies specific operational procedures, developed by the DSDP team, which have been repeatedly demonstrated over more than eight years of Glomar Challenger operations.

Under contract to the U.S. Navy and DARPA, the installation and operation of a special deep ocean seismic instrumentation package has been under study for the past three years. GMDI was contracted to conduct the initial Phase I portion of the MSS Deployment Feasibility Study.[1/] This initial effort was completed in June of 1980. A follow-on Phase II At-Sea-Test Design and Mobilization Planning Program contract[2/] was completed by GMDI in September 1980. The Phase III contract[3/] effort, which commenced 1 October 1980, primarily covered the equipment procurement, mobilization and At-Sea-Test operations which were successfully completed in March of this year. In

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1/ Gould Inc. (CID) Purchase Order No. 00650, dated May 29, 1980 (Prime ONR Contract). Period of Performance June 10, 1980 through September 30, 1980.

2/ ONR Contract No. N00014-80-C-0821. Period of Performance June 10, 1980 through September 30, 1980.

3/ ONR Contract No. N00014-80-C-0821 Mod. P00001. Period of Performance October 1, 1980 through September 30, 1981.

addition, the Phase III contract provided for the follow-on design, development, test, planning and system integration activities associated with the deployment of the prototype Configuration I Borehole Instrumentation Package (BIP) which is scheduled for August 1982. The Phase III effort was completed on 30 September 1981.

Subsequent phases of planned work are:

- Phase IV - October-September 1982 "Configuration I MSS '82 Mobilization and Operations".
- Phase V - October-Setember 1983 "Fly-In" Development Operations.
- Phase VI - October-September 1984 "Configuration II Mobilization and Operations".

The overall MSS Deployment Program has been undertaken as a series of successive contract phases. Figure 2-1 depicted the relationship of the fiscal phased work efforts with the major operational program elements.

A MSS deployment test for developing the "Fly-In" concept is proposed for the 1983 period. Actual "Fly-In" deployment operations are scheduled for 1984. This deployment is required as part of the design process for developing a method of implanting a BIP without use of a drill string and associated drillship.

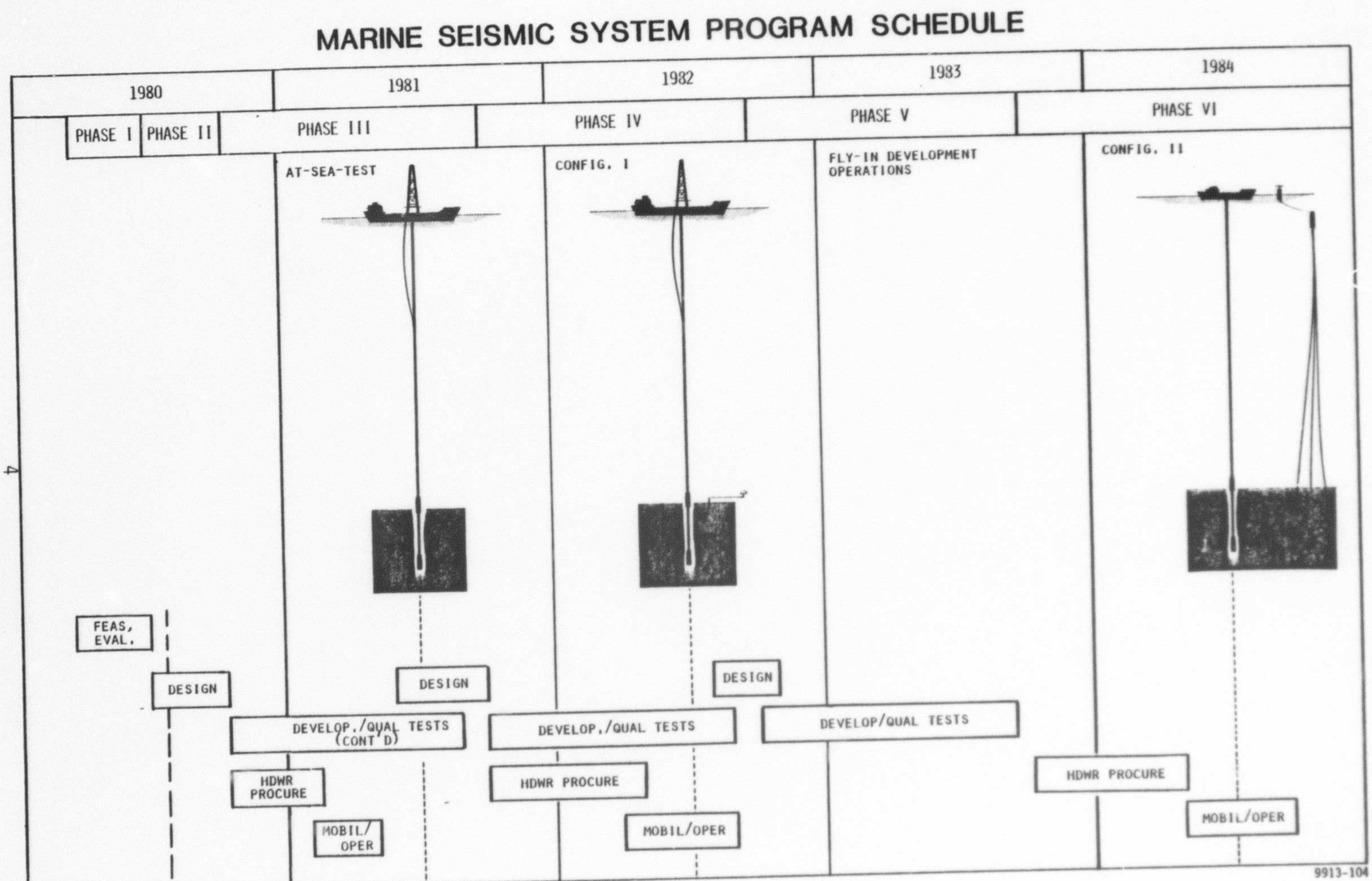

FIGURE 2-1. FISCAL VERSUS OPERATIONAL PHASING

SECTION 3.0 - CONCLUSIONS & RECOMMENDATIONS

Deep ocean drill string deployment of large instrument packages into encased subbottom boreholes has now been demonstrated as feasible. The 1981 mid-Atlantic MSS At-Sea-Test has verified that the concerns of controlled reentry, large impact forces, cable entanglement, release and borehole lowering can be generally accommodated. In addition, recovery of the BIP can also be achieved. The design of the Configuration I equipment for the MSS '82 deployment in the Northwest Pacific is proceed well. Certain new system features will incorporate the experience of the 1981 At-Sea-Test. The addition of the Bottom Processing Package (BPP) plus associated mooring equipment will extend and complicate the overall operation but no major difficulties are foreseen.

The DARPA objective of "Fly-In" deployment for 1984 can be achieved, but only if adequate deployment analysis plus testing can be provided for in 1983. The basic technology for "Fly-In" deployment is available, but spread throughout a number of Navy, scientific and industrial organizations. What is required is integration of these capabilities into a series of successively more sophisticated test demonstrations leading to the actual "Fly-In" deployment in the North Pacific site.

It is recommended that:

- Efforts continue as planned for the MSS '82 demonstration at the proposed Northwest Pacific site using drill string deployment.
- Specific objectives for the 1984 deployment be defined early so that appropriate responsibilities, planning and funding can be established.
- Set-up a specific fly-in deployment working group to oversee implementation of technology.
- Perform conceptual design analysis of "Fly-In" deployment 1982.

- In conjunction with the MSS '82 deployment and recovery operations , perform some simple "Fly-In" oriented experiments.

- Conduct a series of "Fly-In" experiments and demonstrations during 1983.

- Finalize "Fly-In" design during late 1983.

- Fabricate and test deployment equipment in early 1984.

- Mobilize and conduct MSS At-Sea-Operations during mid 1984 at Northwest Pacific site.

SECTION 4.0 - AT-SEA-TEST SUMMARY

4.1 GENERAL

This section summarizes the part of the overall MSS Program associated with the design, fabrication, mobilization, logistic support, modification, planning and operations of the deployment hardware, and the actual conduct of the BIP operations deployment aspects of the MSS '81 At-Sea-Test Program. After only 9 months of effort commencing in June of 1980, the actual deployment operations took less than 4 days to complete. The deployment went very smoothly with no serious problems encountered. Reference 2 provides a more detailed description of the equipment, operations and data.

The following lists depict some of the major accomplishments and highlights of the deployment operations.

- Operations successfully demonstrated the feasibility of emplacing large instrumentation packages into holes pre-drilled in the ocean floor.
- Handling, deployment, release and retrieval of the BIP EM Cable and drill string was successful.
- Deployment procedures were verified.
- High quality seismic data was obtained.
- Impact forces were within design critera.
- Cable entanglement was not a problem at that site.

4.2 OPERATIONS

The MSS equipment was mobilized in San Juan, Puerto Rico and was installed on the Glomar Challenger which departed for the test site on March 14, 1981. The reentry site was located in the mid-Atlantic at latitude 22°45' N, longitude 46°5' W in a water depth of 4,484 meters (14,712 feet). With the ship on site and dynamically holding position, the BIP was lowered to the ocean floor suspended from the drill string. An existing reentry cone emplaced over the borehole was used to guide the BIP into the hole where it was lowered an

additional 609 meters (1,998 feet) into the basalt layer. Over the next two days a series of tests were performed using explosive charges dropped from the USNS Lynch.

Deployment, reentry and recovery of the BIP were achieved without any significant difficulties. There was minimal damage to the BIP, EM Cable or deployment hardware. The entire onsite operation was completed in 73 hours. The successful test demonstration testified to the cooperative planning efforts of NORDA, Geotech, DSDP and GMDI personnel. The experience of the Glomar Challenger marine and drilling crews was invaluable. The overall operation went very smoothly considering the number of new equipment items required, their comlexity, and the untried procedures involved. Based upon the actual experience, the existing procedures (with only minor modifications), can be used with confidence for future deployments.

4.3 SEISMIC MEASUREMENTS

High quality seismic data was recorded by both the BIP and three Ocean Bottom Seismographs (OBS).[4/] Sources were explosives dropped from the support vessel USNS Lynch at various distances from the Glomar Challenger. A total of 113 explosive charges, ranging in size from 0.5 to 120 kg, were dropped by the USNS Lynch at distances of 0 to 65 km from the BIP installation site. The seismic refraction records obtained from the downhole BIP exhibited good first and secondary arrivals with little of the complexity and long reverberation due to converted phases, surface waves and/or channeled waves that normally contaminate OBS explosion records. These data should provide some new and very detailed information on velocity structure of the oceanic crust. The background noise level recorded by the downhole seismometer appeared to be very low, lower than the noise level measured by OBS.

4/ The data measurement aspects of the program are the subject of a separate report (TR 81-6) by Teledyne-Geotech.

4.4 VESSEL DESCRIPTION

The D/V Glomar Challenger, utilized for the MSS At-Sea-Test, is a specially constructed, dynamically-positioned drillship operated by Global Marine Drilling Co. under direction of Scripps Insitution of Oceanography, University of California, San Diego. Scripps operates the Deep Sea Drilling Project (DSDP) on behalf of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES).

The Glomar Challenger, Figure 4-1, was placed in service in 1967. It has a length of 139 M (400 feet), beam of 20 M (65 feet) draft of 6 M (20 feet) and displaces 10,500 long tons. The drilling equipment is characterized by the 43 M (142 feet), 454,000 kg (1 million pound) derrick. Approximately 11,600 M (38,000 feet) of special S-135, 13 cm (5 inches) drill pipe is carried plus associated drill collars, bumper subs, swivels, etc.

An early version Delco type ASK (Automatic Stationkeeping) system is used to mantain position over a deployed short baseline beacon. Automatically, the ship propulsion screws and/or thrusters are directed to maintain desired position.

A total crew of 74 marine, drilling and scientific personnel can be accommodated. Typical legs last about 2 months at which time a complete crew changeover is accomplished.

4.5 INSTRUMENTATION SUBSYSTEM

The MSS instrumentation package consisted of two functional subsystems. These were the Borehole Instrumentation Package (BIP) and the Shipboard Test Console (STC). The STC system supplied power to the BIP, performed data recording and monitoring, and displayed selected data plus real time "state-of-health" information on various equipment. The BIP and STC were connected by a 1.58 cm (0.692 inch) diameter electro-mechanical (EM) Cable through a slip rig assembly on an EM Cable winch. DC power was applied to the BIP and digital data was transmitted to the STC via this cable. The armored EM Cable

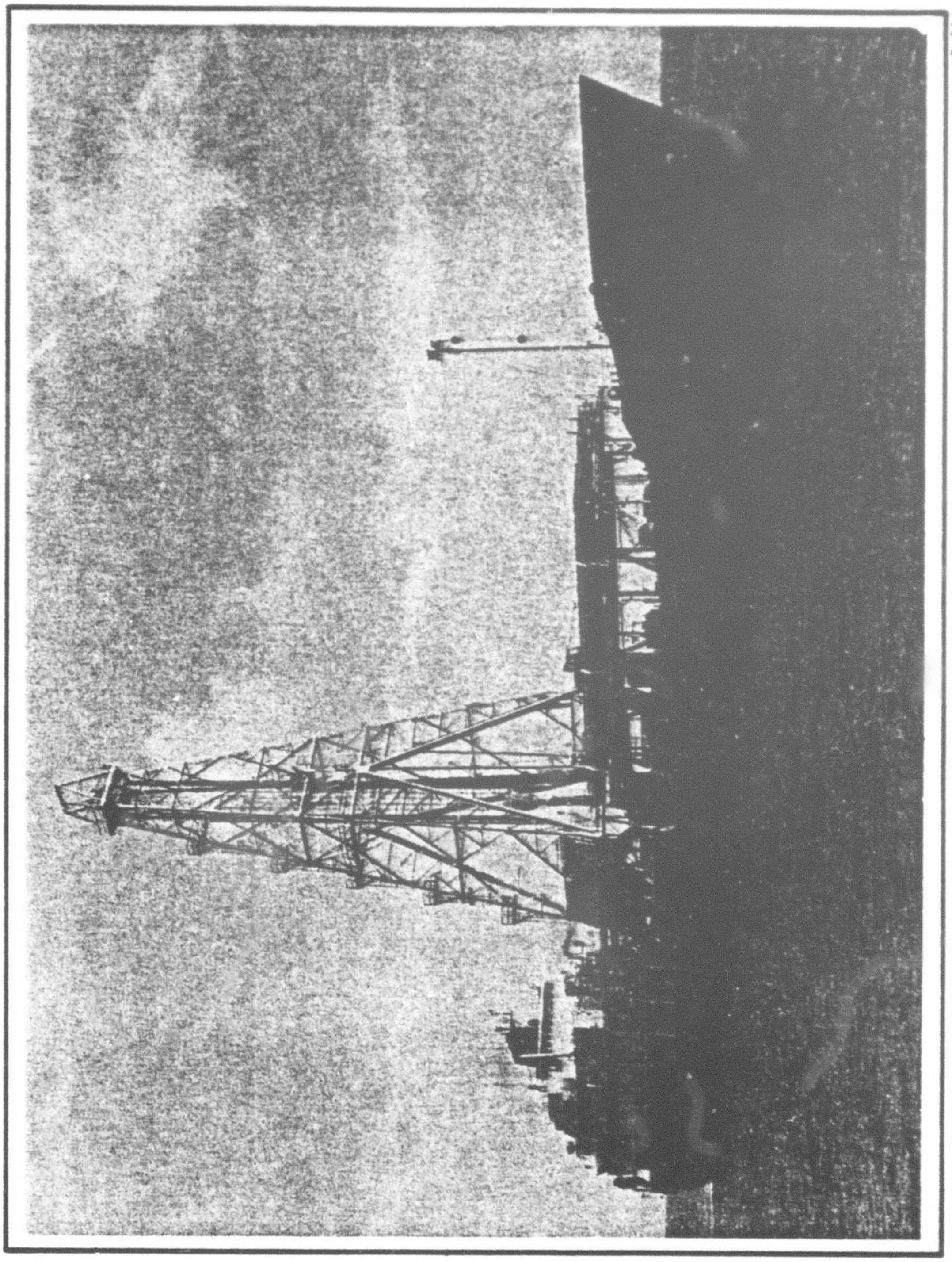

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FIGURE 4-1 GLOMAR CHALLENGER

provided the necessary mechanical strength to effect the installation and retrieval of the BIP.

The BIP (Teledyne-Goetech Model 53100) is an assembly of acceleration, seismic, temperature, pressure and state-of-health sensors along with associated signal conditioning and control electronics packages.

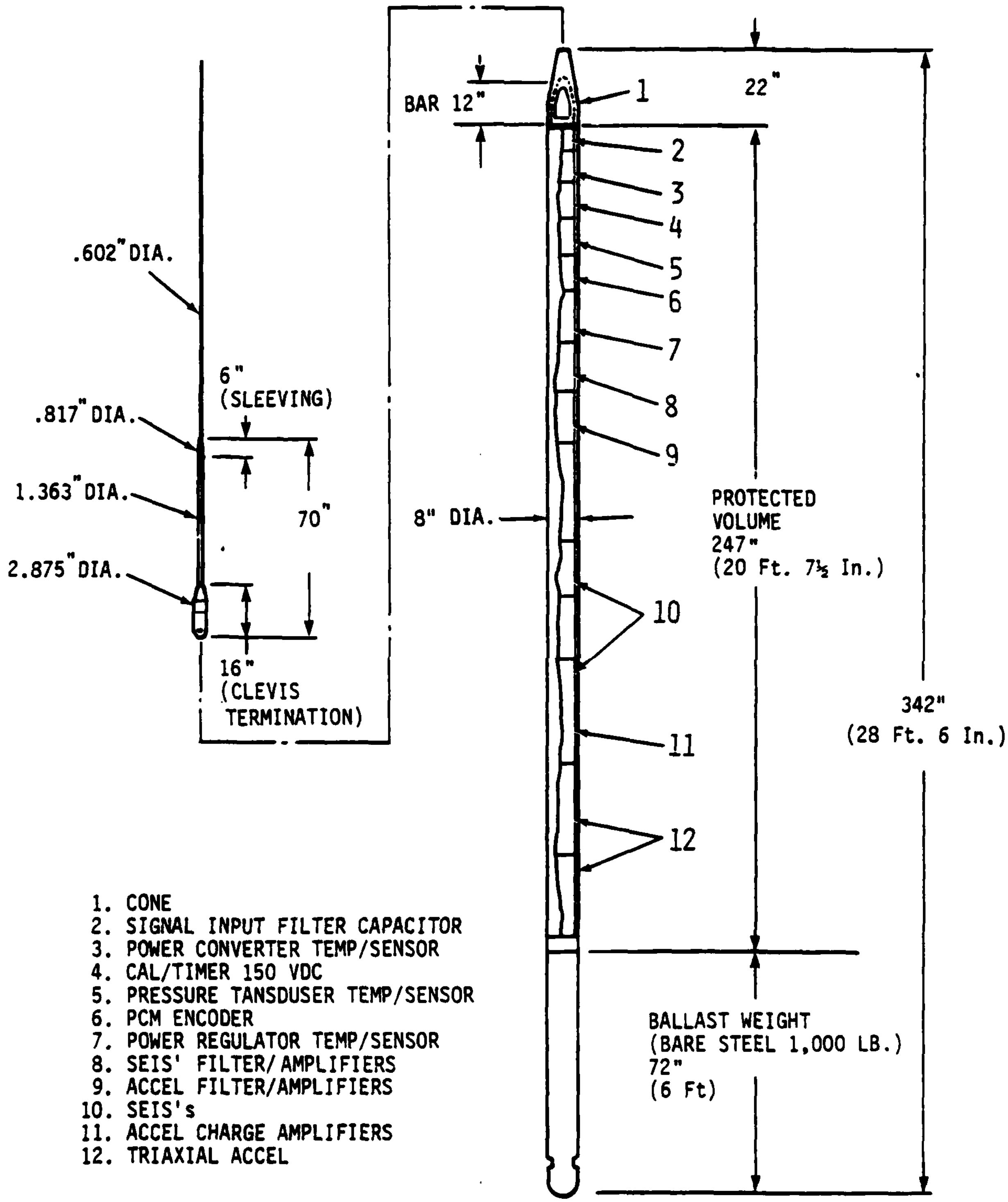
The BIP was 8.7 M (28 feet 6 inches) long overall with an OD of 20.3 cm (8 inches). Basically the package consisted of a pressure vessel instrumentation section enclosed in a pressure tight container plus a ballast weight section. Total weight was approximately 1,590 kg (3,500 pounds). The mechanical configuration outline is shown by Figure 4-2.

4.6 DEPLOYMENT EQUIPMENT

The MSS At-Sea-Test deployment equipment was broken down into two basic categories, shipboard and subsea. The shipboard equipment consisted of a dual "bull wheel" single drum EM Cable winch supplied by the U.S. Navy, a specially constructed overside A-Frame, a single cylinder heave compensator adapted from a guideline tensioner, and a large swiveled sheave block. This equipment was mounted on the portside main deck area located between the derrick subbase and the casing support rack structure.

The subsea equipment basically consisted of a reentry sub which was attached to the lower end of the drill string and a specially designed coaxial EM Cable provided by the U.S. Navy. The reentry subassembly was made up of a carriage, carriage housing, stinger and control sub. The reentry subassembly accommodated a shock mounting for the BIP for impact reentry into the borehole. Figure 4-3 depicts some of the onboard deployment equipment.

The EM Winch was a Navy supplied double "bull wheel" manufactured by the Pengo Co. of Ft. Worth, Texas. The winch is mounted to a specially welded deck foundation.



1. CONE
2. SIGNAL INPUT FILTER CAPACITOR
3. POWER CONVERTER TEMP/SENSOR
4. CAL/TIMER 150 VDC
5. PRESSURE TANSDUSER TEMP/SENSOR
6. PCM ENCODER
7. POWER REGULATOR TEMP/SENSOR
8. SEIS' FILTER/AMPLIFIERS
9. ACCEL FILTER/AMPLIFIERS
10. SEIS's
11. ACCEL CHARGE AMPLIFIERS
12. TRIAXIAL ACCEL

FIGURE 4-2 AT-SEA-TEST BIP MECHANICAL OUTLINE

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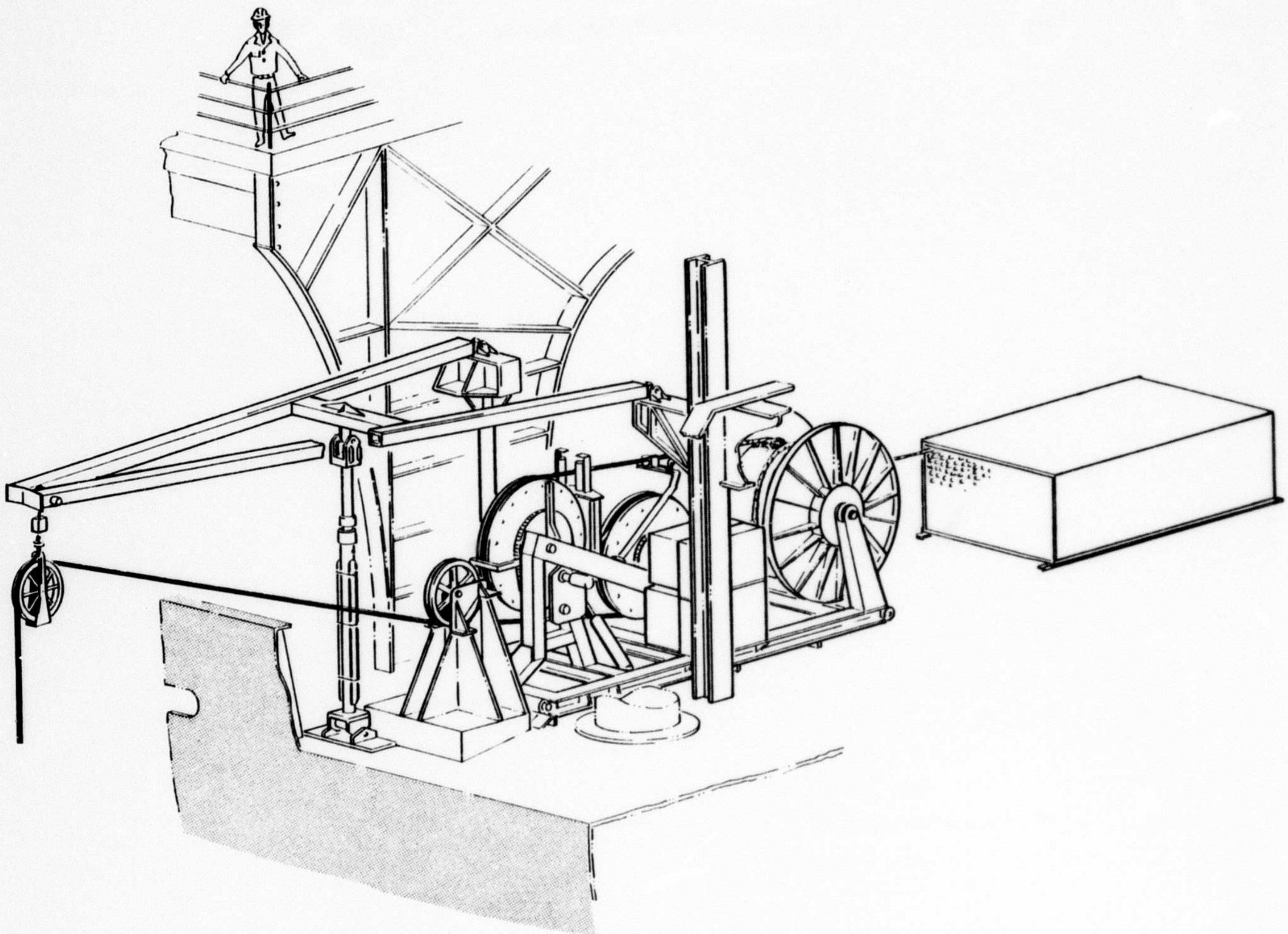

FIGURE 4-3 EM WINCH/A-FRAME/HEAVE COMPENSATOR INSTALLATION

0006-039

The A-Frame structure was of simple design mounted on two pinned inboard pedestals and attached to a central heave compensator cyclinder. The A-Frame projected above the deck about 2.44 M (8 feet) and overhung the side approximately 4.6 M (15 feet). The A-Frame was rated at and tested to 12,730 kg (28,000 pounds). The heave compensator was operated off a single accumulator pressurized by standard nitrogen bottle.

The overall reentry sub (Figure 4-4) was approximately 68 feet long and weighed about 7,545 kg (16,600 pounds). There were four bumper subs plus a small drill collar below the transition to the drill string. This gave a reentry assembly weight similar to the weight of the drill string downhole assembly normally used.

The BIP was carried off the reentry sub centerline during the initial deployment and reentry stab. The BIP was then displaced laterally by salt water hydraulic actuations. This achieved release and allowed the BIP to be lowered carefully into the borehole.

4.7 DEPLOYMENT MEASUREMENTS

Acceleration data from the BIP, and EM Cable loadings were recorded during the entire shipboard handling, deployment, reentry, lowering in borehole, and recovery operations. No unusual loads or forces were noted, and the recorded data verified the original design criteria. Specific accelerometer and load cell data is reported in Reference 3.

FIGURE 4-4 FIELD TEST OF REENTRY SUB

SECTION 5.0 - CONFIGURATION I DEPLOYMENT PRELIMINARY DESIGN

5.1 DESIGN

Preparatory for MSS '82, a preliminary Test Plan Outline (Appendix A) and Interface Requirements Specification (Appendix B) has been prepared and distributed. These documents will serve as the basis of design and for interface control. They will be updated periodically as required.

The successful 1981 mid-Atlantic BIP Deployment indicated several reentry design areas where improvement would be desirable. In particular, the deployment conditions of the mid-Pacific site will be much more extreme than the mid-Atlantic site. The areas of concern are:

- Strengthen stinger/housing interface section.
- Provide full peripheral seating in reentry cone.
- Reduce release "G" shock.
- Improve BIP installation into housing.
- Reduce time in reentry cone.
- Eliminate moveable reentry tool plug.
- Provide greater protection to hydraulic tubing.

A series of conceptual studies were developed to evaluate remedies of the above concerns. The centering of the BIP in-line with the pipe string centerline was also looked at, but could not be physically accomplished. Leaving the stinger in the reentry hole which would eliminate the stinger slot, was deleted at NORDA request, because the hole could not be reentered due to the stringer blocking the hole.

The revised design ends up with accomplishing a majority of the objectives without introducing any new concepts. The Configuration I design will incorporate the following revised features:

- Added 1.6 M (5 foot) length to accommodate its longer BIP.
- Socket type stinger/housing interface with 10-times greater section modulus in bending.
- A 300° peripheral seat interface with the reentry cone.
- Elimination of moving reentry tool hydraulic plug adapter.
- Incorporate breakaway sonar adaptor in the stinger to replace the moveable plug adaptor.
- Use a simplified Baker packing tool.
- Incorporate an orifice in the hydraulic lines to reduce carriage transitory release motion.
- Improved BIP mounting in carriage.
- Reconfigured shear pin for easier alignment and locking.

These modifications are being incorporated into the Configuration I preliminary design as shown by Figure 5-1 and drawings in Appendix D. The stinger impact end is similar to the previous design, but without the large hydraulic plug to absorb part of the shock loading. Thus, detail impact and structural analysis on this design is to be accomplished early in Phase IV. The stinger/socket design can be easily modified to incorporate a releasible stinger if later desired.

There are a variety of small design revisions required which are associated with the Glomar Challenger shipboard handling equipment. The load cell will be incorporated into the idler sheave structure. The new load cell will be calibrated to line tension and read out on a dial gage plus a 2-track analog recorder. An improved communications network between van and winch will be installed. Special BIP handling slings will be provided to help reduce impact shocks. The heave compensator system will be revised to utilize available ship high pressure air. The above design efforts will be initiated in October 1981.

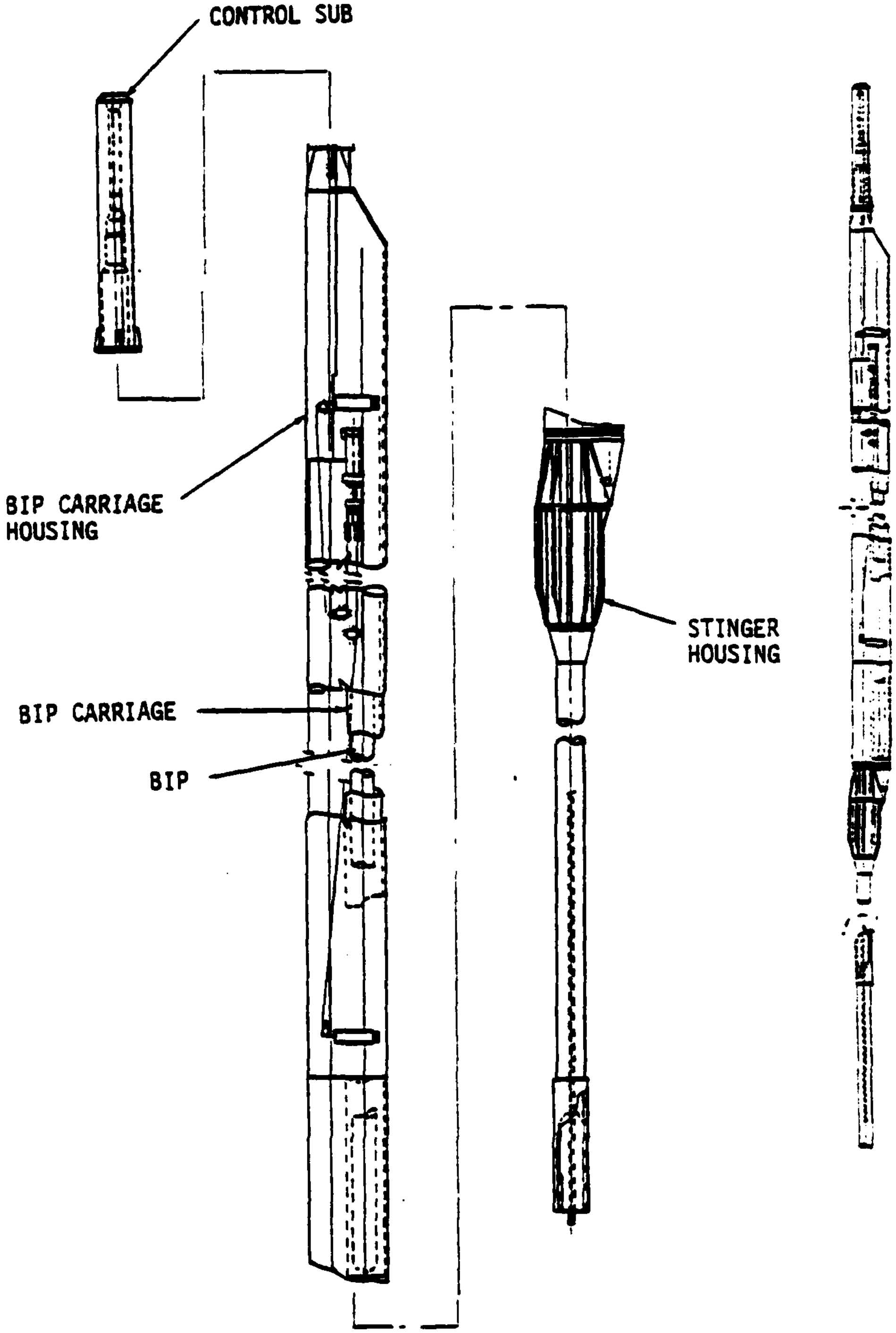

FIGURE 5-1
MSS '82 CONFIGURATION I REENTRY ASSEMBLY

Deployment of the DARS buoy and the associated mooring system should not require any great amount of additional equipment. The A-Frame and idler sheaves must be modified to accommodate the larger tentatively 3.8 cm (1-1/2 inch) diameter mooring line. A walkway along the A-Frame may be desirable to facilitiate line and cable changes. There will be special EM Cable and mooring line stops to be designed. Deck and handling equipment space for the temporarily stored mooring line must be provided for.

5.2 ANALYSIS

Five major areas of engineering analysis involved with the Configuration I design have been identified as follows:

- Impact Analysis
- Cable Analysis
- Bending Analysis in Reentry Cone
- Drill String Dynamic Analysis
- DARS Deployment Loads

Except for some initial cable analysis, these efforts have been deferred to early Phase IV time period.

The impact analysis will follow closely the efforts performed during Phase II. The analysis will reflect the revised structural configuration of the reentry stinger and lower reentry sub housing.

Cable entanglement is still a major consideration, because the MSS '82 loading levels on the EM Cable will approach 50%. The Phase II analytical work will be upgraded to correspond to the deeper water, more severe seas, and greater current conditions of the Northwest Pacific site. A new dynamic EM Cable loading program is also to be developed for use at sea. The existing static program will be modified to improve our understanding of the current effects.

During the period when the reentry sub remains in the reentry cone, large dynamic bending moments are incurred. There remains a critical question as to the lower drill string transition above the reentry assembly. As a consequence, a detailed analysis of this specific condition will be undertaken.

Evaluation of the 5,800 M (19,000 feet) plus drill string loading functions is expected to be performed by DSDP. However, this could be a critical area particularly since the drill string is considered to be marginal for projected heavy weather conditions at the Northwest Pacific site.

The deployment mooring line dynamic loads must be carefully evaluated. In particular, the time when the DARS package is overside or just beneath the surface will be most critical. The mooring line diameter should be kept small due to drag, space, and reel limitations.

SECTION 6.0 - MSS '82 OPERATIONS PLANNING

Only a limited effort has gone into the specific operational planning for MSS '82. The basic operational procedures for deployment of the BIP will be almost identical to those developed for the 1981 At-Sea-Test (Ref. 4). Minor revisions will need to be incorporated to accommodate the new winch and the revised salt water hydraulic packer tool. Due to the greater depth of water, new specific cable loading characteristics will need to be defined. Improved shipboard handling techniques for the BIP are under study. Table 6.1 summarizes the expected on site activities.

A preliminary outline of the steps involved with deployment of the DARS/BPP bottom package plus associated subsurface buoys and mooring have been developed and are included in Appendix C. No major problems are foreseen although handling the DARS package overside in only moderate weather conditions will be somewhat difficult. Stopping off the EM Cable and the mooring line, and transferring loads under heavily loaded conditions must be carefully undertaken.

An MSS '82 operational plan based upon the 1981 At-Sea-Test Operations will be generated early in Phase IV once the DARS equipment configuration has stabilized.

TABLE 6.1

MSS '82 OPERATIONS TIME ESTIMATE

HOURS	OPERATION
4	Establish stationkeeping grid
32	Makeup assembly, run in and establish mudline
58	Coring through sediments
24	Pull out, makeup casing and cone and run in to seafloor
20	Wash down and land guide cone
62	Core into basalt or to TD @ approximately 6,100 m
36	Pull out, makeup and run 11-3/4 OD casing
12	Pull out with drill pipe and running tools
8	Makeup carriage assembly and install BIP
15	Deploy pipe string to top of Guide Cone
6	Run Edo tool and make reentry
4	Release BIP, run to bottom and move ship off
120	Gather real time data
2	Pay out all EM Cable and secure
24	Connect, pot, cure and check out EM Cable to DARS
	(Spool synthetic rope on EM Winch during this time)
2	Attach synthetic rope and launch DARS package
4	Run DARS package to seafloor
3	Pull back the required distance and attach subsea buoy
2	Attach launching wire, launch, run and release subsea buoy
2	Recover launching gear and secure
440 TOTAL	

TIME ON LOCATION - 18 DAYS AND 8 HOURS

SECTION 7.0 - MSS '82 MOBILIZATION PLANNING

A preliminary evaluation outline of the MSS 82 mobilization activities has been developed based upon leaving from and returning to the Japanese port of Hakodate on the island of Hokkaido. The port of Hakodate represents the latest planning by DSDP. The earliest take-off date to the MSS North Pacific site is now projected to be mid-August 1982.

Mobilization activities will be initiated in early 1982 with the finalization of detail planning. Two basic collection areas of MSS equipment will be organized; one in the Houston, Texas area and one from the Port Hueneme, California area. From the Texas area, the following major equipment items will be shipped to Japan via MSC.

- Pengo Winch
- 2 BIP's
- STC Van
- EM Cable

Tentative shipment date is 1 June 1981.

From the Port Hueneme area, the following major equipment items will be shipped to Japan via MSC.

- Reentry Assembly with 2 Stingers
- TV Equipment
- A-Frame
- Load Cell Readout Instrumentation
- Heave Compensation System
- Dual Ship Cable Release Equipment
- Winch Special Idler Sheave
- A-Frame Sheaves
- Reentry Cone & Casing Hangers (DSDP furnished)
- IRR Mooring Line
- IRR Cables & Buoys
- BPP Sled with DARS

Tentative shipment date is 15 June 1982. Certain items, from the Houston consignment, could be trucked directly to Long Beach. For certain critical electronic components, air shipment will be arranged.

This MSS equipment will be received in a MSC port and trans shipped to the Hakodate shipyard. At this state, all equipment will be inspected and tested as required. Certain new items will be fabricated in the shipyard as follows:

- A-Frame Walkway (if required)
- HC Air Piping
- BIP & DARS Handling Equipment
- EM Winch Auxiliaries

A final MSS system checkoff and functional test will be performed dockside prior to the departure of the Glomar Challenger.

SECTION 8.0 - PROPOSED ALTERNATE REENTRY CONCEPTS

8.1 OBJECTIVES

The stated objective of the MSS program is to provide an alternative to the drill string deep water deployment technique of the BIP.

Various "Fly-In" and cable guideline approaches were evaluated in the MSS Deployment Phase II Summary Report (Reference 1). Although there are several optional ways to reenter a borehole with a large seismic package, the "Fly-In-On-A-Cable" technique appears to offer the greatest potential.

Accordingly, the MSS program is proceeding toward the objective of providing the capability to retrieve the existing BIP and "Fly-In" an improved BIP sensor at the DARPA Northwest Pacific site (during 1984).

8.2 TECHNICAL EVALUATION

A limited investigation on promising "Fly-In" concepts has been continued during this Phase III period. This effort has primarily focused on contacting various Navy, scientific and industrial organizations to review previous related work.

In any "Fly-In" evaluation, the question of subsea platform propulsion and/or sophisticated control becomes of paramount importance. Past experience strongly indicates that automatically controlled subsea thruster systems require a very long and expensive development program. Thus, the basic criterion adopted herein is to develop the simplest deployment system relying basically on surface ship maneuvering and incorporating existing ASK positioning equipment plus deployment package sonar ranging or long base positioning equipment. A simple platform thruster pulse augmentation may be later considered to reduce the deployment time period. Table 8.1 summarizes the "Fly-In" technology status.

TABLE 8.1

"FLY-IN" TECHNOLOGY STATUS

- o Deep water hovering of small hydrodynamic vehicles has been accomplished
- o Sonar reentry tool or LBS (Long Board System) positioning equipment available for navigation
- o Dynamic positioned surface vessel provides improved positioning capability
- o Circling technique partially demonstrated
- o Existing cable dynamic programs available as analytical tools
- o Kevlar rope can be potentially utilized as towing cable

UNCERTAINTIES

- o Dynamic response of cable suspended non-hydrodynamic shaped platform to ship wave motions
- o Effect of ship maneuvering on cable suspended vehicle
- o Effect of cable rotation on platform navigation equipment

The typical operational scenario for MSS "Fly-In "deployment would be as follows. Utilizing a USN AGOR or equivalent vessel, pick-up and recover the DARS/BPP bottom package using the IRR system and retrieve the BIP by attaching to and winching in, the EM Cable. Then, lower the subsea deployment platform, including BIP, on a special deployment cable. By surface maneuvering of the AGOR, position the subsea deployment platform over the reentry cone and quickly guide into the reentry cone. The BIP is then released and lowered into the borehole. After conducting final checks plus cementing if required, recover the deployment platform and redeploy the DARS system.

Two promising "Fly-In" positioning approaches rely on maneuvering the surface vessel to direct the deployment package over the reentry cone by iterative compensating motions. The first approach uses normal surface vessel maneuvers plus possible lateral thruster to position the deployment package over the reentry cone. The subsea platform is directed over the reentry cone by successive surface repositioning about an established beacon similiar to the drill string deployment procedures. This type of manuevering would be time consuming due to the platform long response time characteristics. Any changes in sea-state or current can readily affect a final stable position. DSDP, HIG (Hawaii Institute of Geophysics) and NCEL (Reference 3 & 4) are undertaking some limited evaluation efforts directed toward this deployment technique. Figure 8-1 depicts this type of cable "Fly-In" reentry utilizing a dragging chain to retard the motions.

The second approach utilizes a surface vessel circling maneuver to establish a stable position. Figure 8-2 depicts this approach. It is possible that a stable lateral/vertical platform position can be established by appropriate control of surface speed and turning radius controlled in conjunction with cable length. Several studies (Reference 5 & 6) have addressed this technique and indications are that it has been partially demonstrated At-Sea. The advantages of circle tow approach are summarized in Table 8.2. However, the feasibility of this circling has not been conclusively verified either analytically or experimentally.

MSS 84 CONFIGURATION II DEPLOYMENT

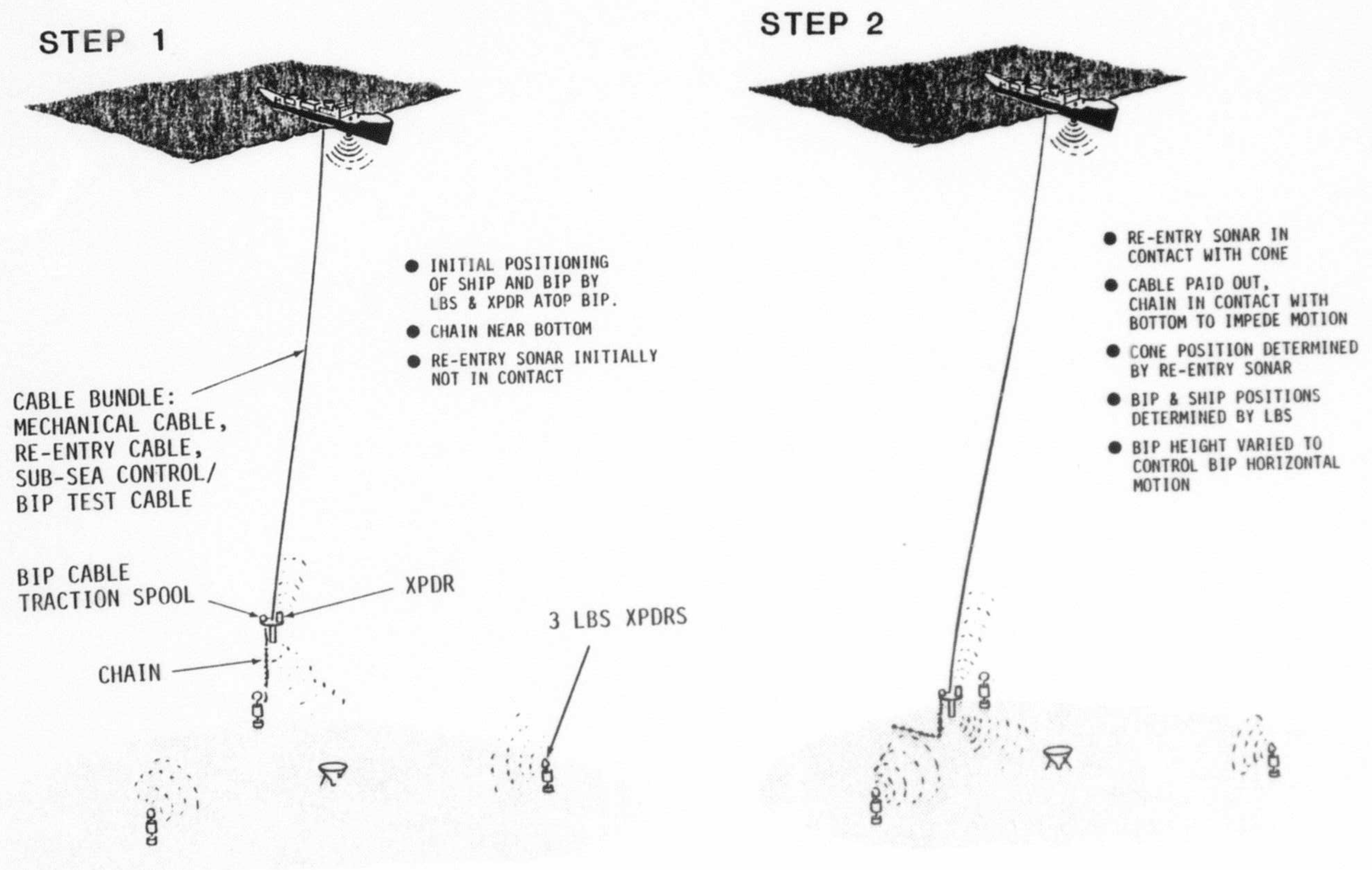

FIGURE 8-1 RETARDED TOW CONCEPT

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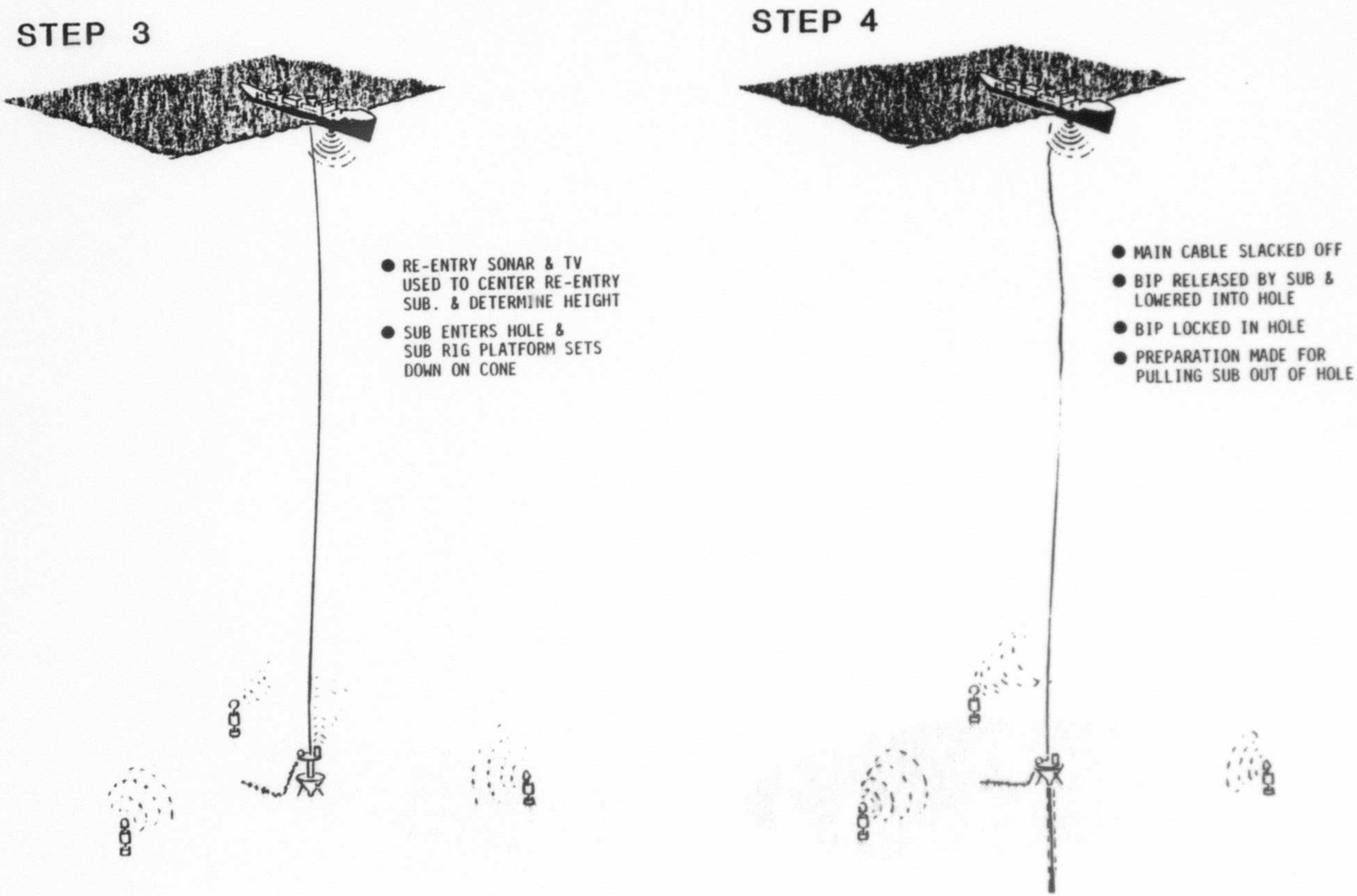

FIGURE 8-1 (cont'd)

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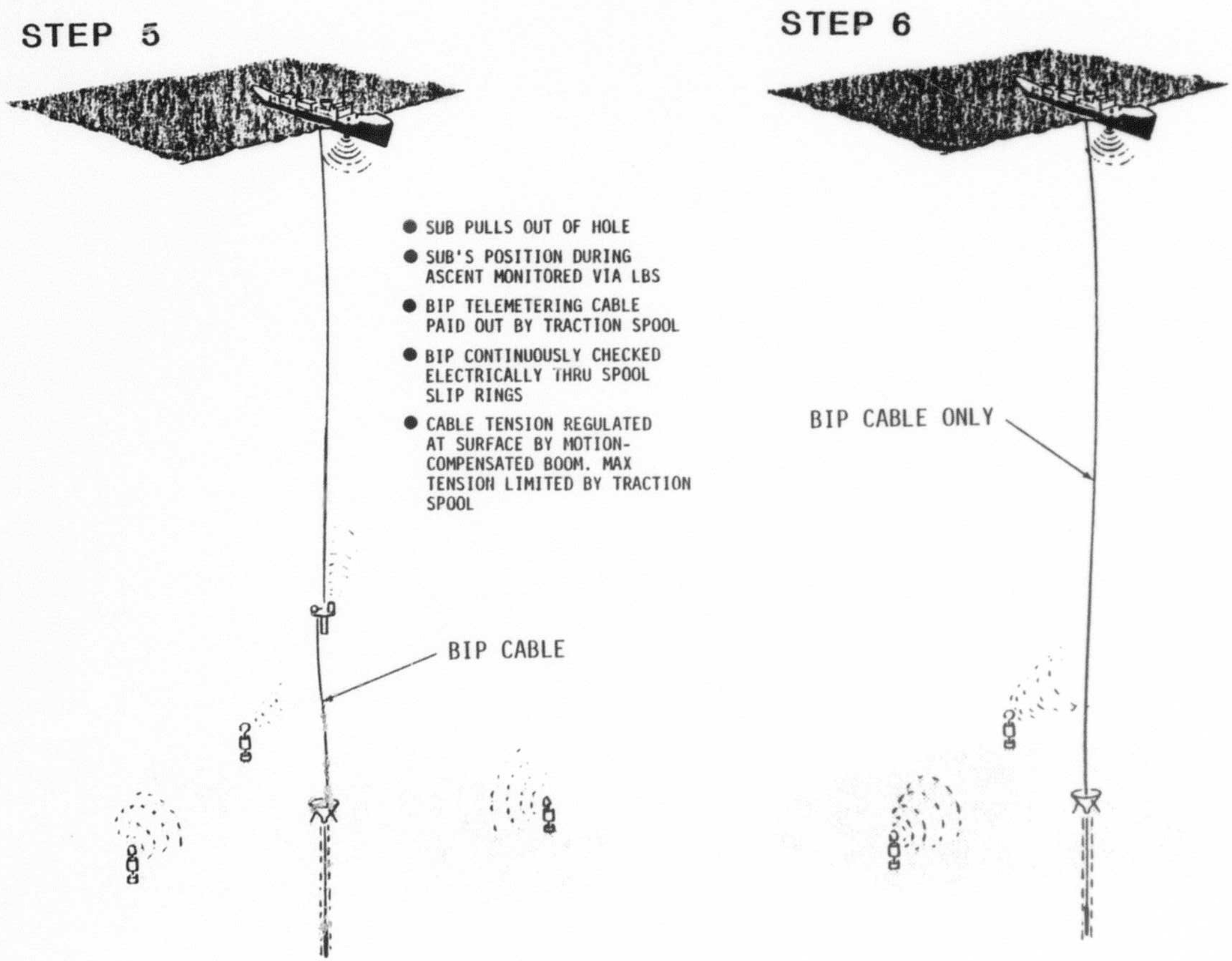

FIGURE 8-1 (cont'd)

0006-036

CIRCLE TOW GEOMETRY

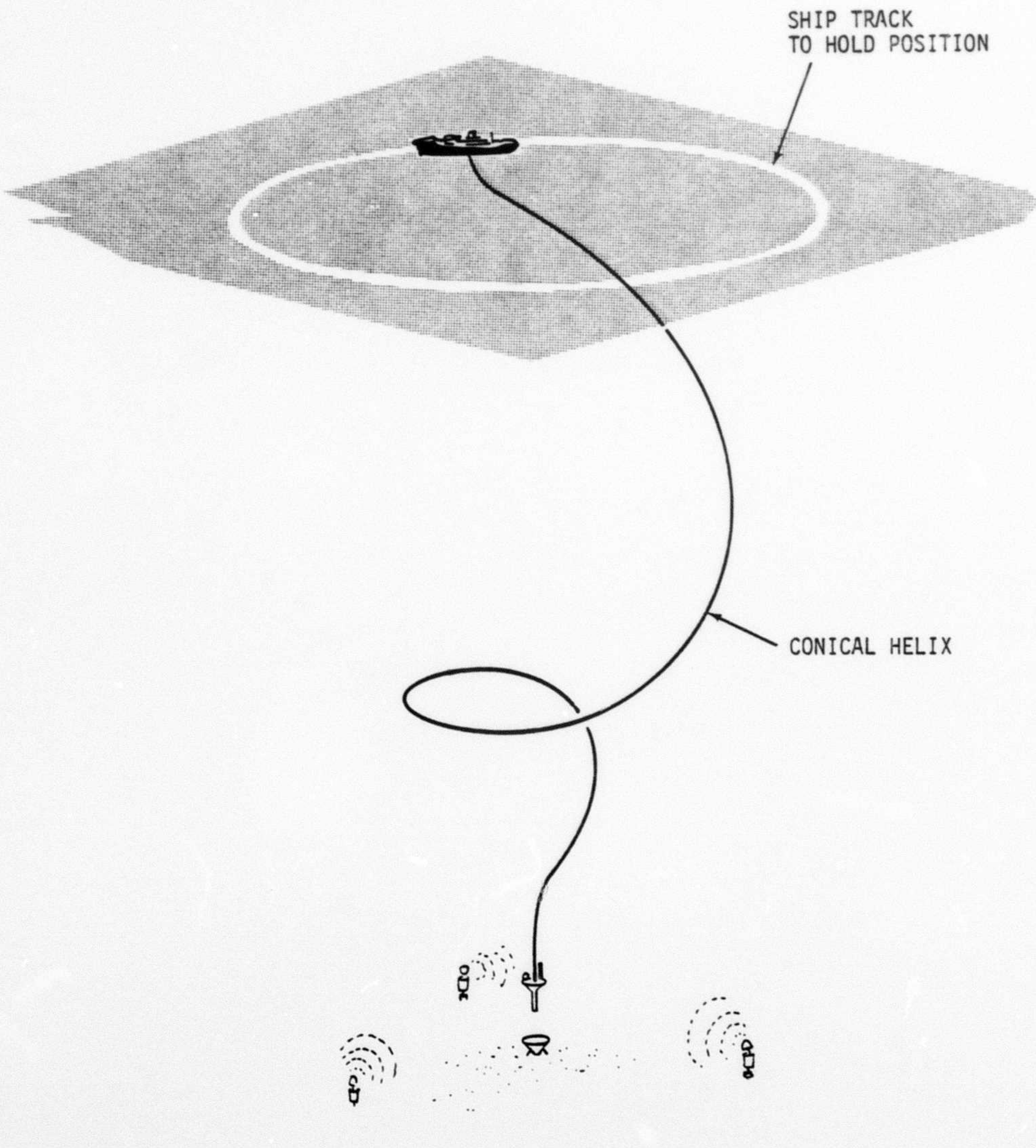

FIGURE 8-2 CIRCLE TOW GEOMETRY

TABLE 8.2

CIRCLE TOW POTENTIAL ADVANTAGES

- Surface ship gains maneuverability with forward speed
- Speed is held constant
- Cable always over stern - decoupled from roll
- Lower risk of fouling cable at surface
- Bow thruster helpful, but not essential
- More tow cable deployed provides more decoupling of ship's heave and pitch to subsea package - i.e., less motion compensation stroke
- Better control of translation at low velocity

There are other major deployment considerations besides just positioning. The platform must be able to:

- o Position and guide into the borehole reentry cone sector.
- o Attenuate the impact G loadings to the BIP.
- o Release and lower the BIP to the bottom of the borehole.
- o Possibly emplace cement.
- o Disengage for recovery.

Table 8.3 presents a more detailed list of the general requirements for a "Fly-In" deployment.

All of the above capabilities must be integrated into a light weight easily handleable configuration. In addition, all actions must be accomplished without entanglement between the EM Cable and the platform support/sonar cable. The potential for cable entanglement presents a major problem and arises from the possible need for two cables required to separate the short term deployment control features from the more restricted 5-year life BIP EM Cable seismic functions.

Various options for determining the subsea position of the platform relative to the reentry are being investigated. Figure 8-3 schematically depicts these options presenting major equipment alternatives. Option I requires the least development and is the most flexible if cable entanglement can be prevented. Option II requires special equipment within the BIP, a high pressure releasable termination and a high strength EM Cable. Option III requires development of a large subsea winch and a large platform to accommodate it. Option IV utilizes an expensive low data rate acoustic command and control subsystem.

The resulting deployment platform will be of similar size and configuration to the drill string type MSS reentry sub but without the need for the BIP offset. Figure 8-4 depicts an Option I type platform. The package weight will be approximately 7,874 kg (20,000

TABLE 8.3 - REQUIREMENTS FOR "FLY-IN" DEPLOYMENT PLATFORM

- Accommodate and handle 30,000 feet of EM Cable, 25,000 feet of deployment cable, plus 20,000 feet of DARS mooring line.
- Provide ASK type vessel positioning system.
- Use vessel thruster augmentation for surface vessel.
- Provide subsea sonar ranging or long baseline platform position reference system.
- Attain directional stability for subsea platform.
- Achieve reentry capability into borehole.
- Provide impact shock isolation for BIP.
- Provide subsea release mechanism and control.
- Avoid entanglement of cables.
- Consider possible motion attenuator (i.e., dragging chain).
- Consider possible cementing capability.

MMS FLY-IN CONTROL OPTIONS

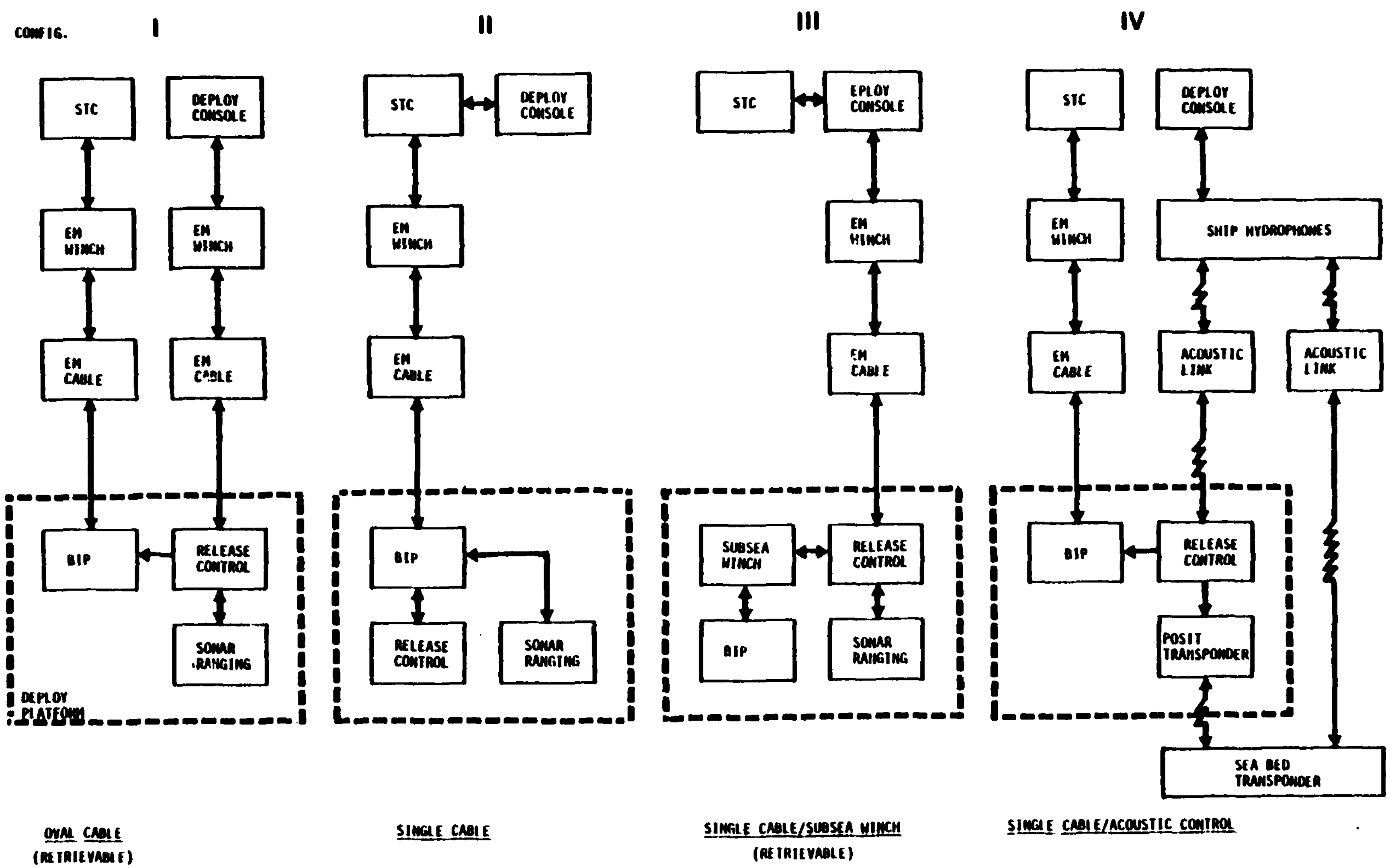

FIGURE 8-3 SCHEMATIC OF MAJOR EQUIPMENT OPTIONS

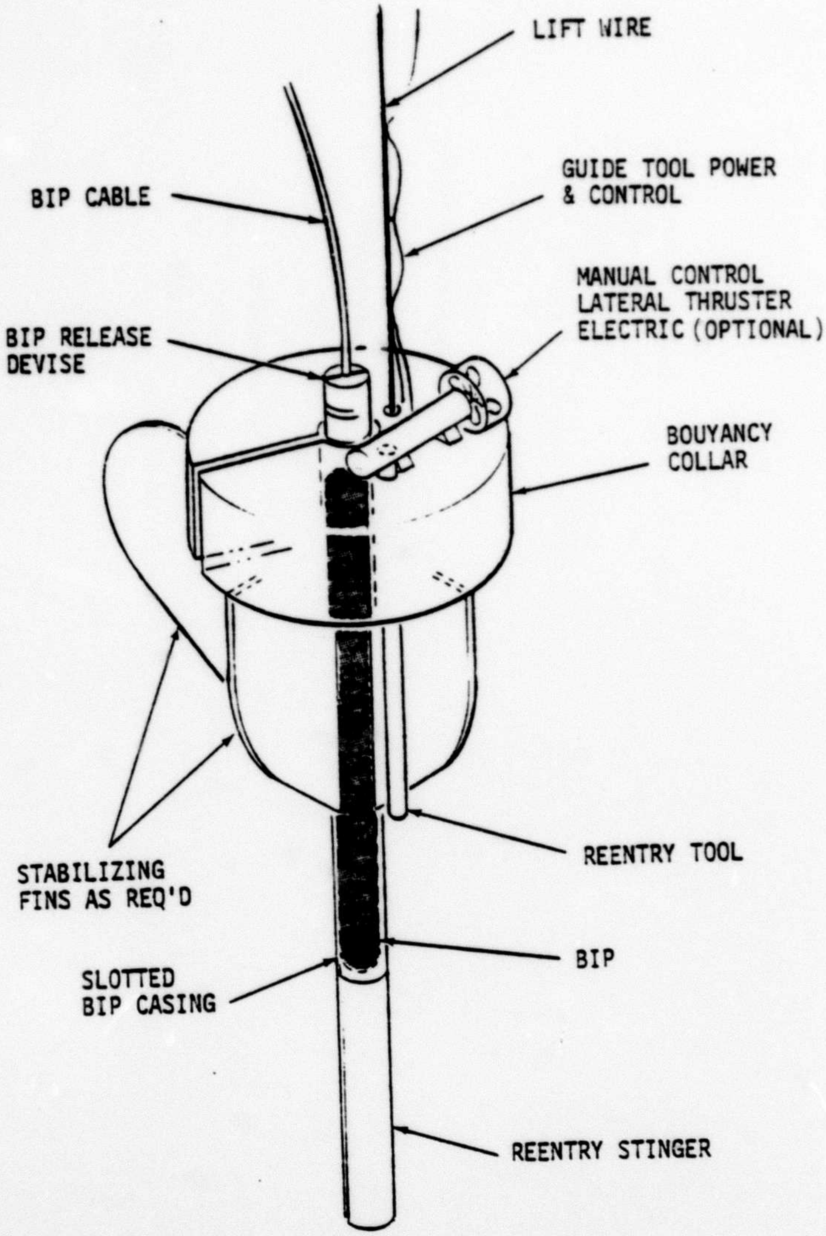

FIGURE 8-4 RETRIEVABLE MSS FLY-IN PLATFORM

pounds) including BIP. A separate deployment cable is provided for to support, control and recover the subsea platform. An expendable cable and platform may be justifiable. A sail or vane will probably be required to maintain a desired orientation of the deployment platform.

A simple "Fly-In" cable dynamics HP 41VCV computer program is being developed to quickly evaluate the conceptual approaches to ascertain basic system characteristics. This program will be utilized to evaluate response of the subsea deployment platform to surface vessel maneuvers. In particular it will be used to approximate the time periods necessary to achieve stability.

8.3 PROPOSED DEVELOPMENT PROGRAM

Although basic feasibility of deep water "Fly-In" deployment appears to be assured; actual data is needed to verify maneuvering capabilities, platform/cable response characteristics, and drag relationships. An outline of a possible development test program is presented on Table 8.4 which leads up to the MSS '84 operation. The program outlined would utilize the available capabilities and resources to the greatest extent possible.

TABLE 8.4

PROPOSED FLY-IN DEVELOPMENT PROGRAM

o Conceptual analysis on maneuvering characteristics.	Oct-Nov 82
o Preliminary design of deployment platform & cable handling system.	Dec-Jan 83
o Model testing of deployment platform.	Feb-Mar 83
o Shallow water (1,000-2,000 feet) reentry of mockup.	Apr 83
o Two-day deep water test of mockup utilizing.	April-July 83
o Deep water testing at DARPA site.	Aug 83
o Final design of deployment system.	Oct-Dec 83
o Procurement & test of deployment system.	Dec-Mar 84
o Mobilization of deployment system & BIP.	May-June 84
o MSS '84 operation.	Jul 84

SECTION 9.0 - MSS DEPLOYMENT PROGRAM PLAN

9.1 INTRODUCTION

An overall program plan was initially developed during Phase I and was further refined during Phase II and III. The intent of this plan was to guide the technical effort and provide applicable cost projections. The overall program currently encompases six phases covering a period of about three and one-half years. The six phases are:

PHASE	ACTIVITY
I	Feasibility Study
II	Analyses, Test Planning and At-Sea-Test Design
III	Test Program and Final Configuration I Design
IV	MSS '82 - Configuration I Mobilization and Deployment
V	"Fly-In" Deployment Development
VI	MSS '84 - Configuration II Mobilization and Deployment

The deployment activities encompass drilling the borehole, setting the borehole casing with reentry cone, installation of the BIP, and installation of the associated mooring, power, control and communication equipment.

9.2 SCHEDULE AND WBS

Figure 9-1 indicates the scope of the overall program schedule based upon tentative deployment in the North Pacific area during the July-August 1982 and 1984 periods. Figure 9-2 presents a work breakdown structure that can be used throughout all phases of the program.

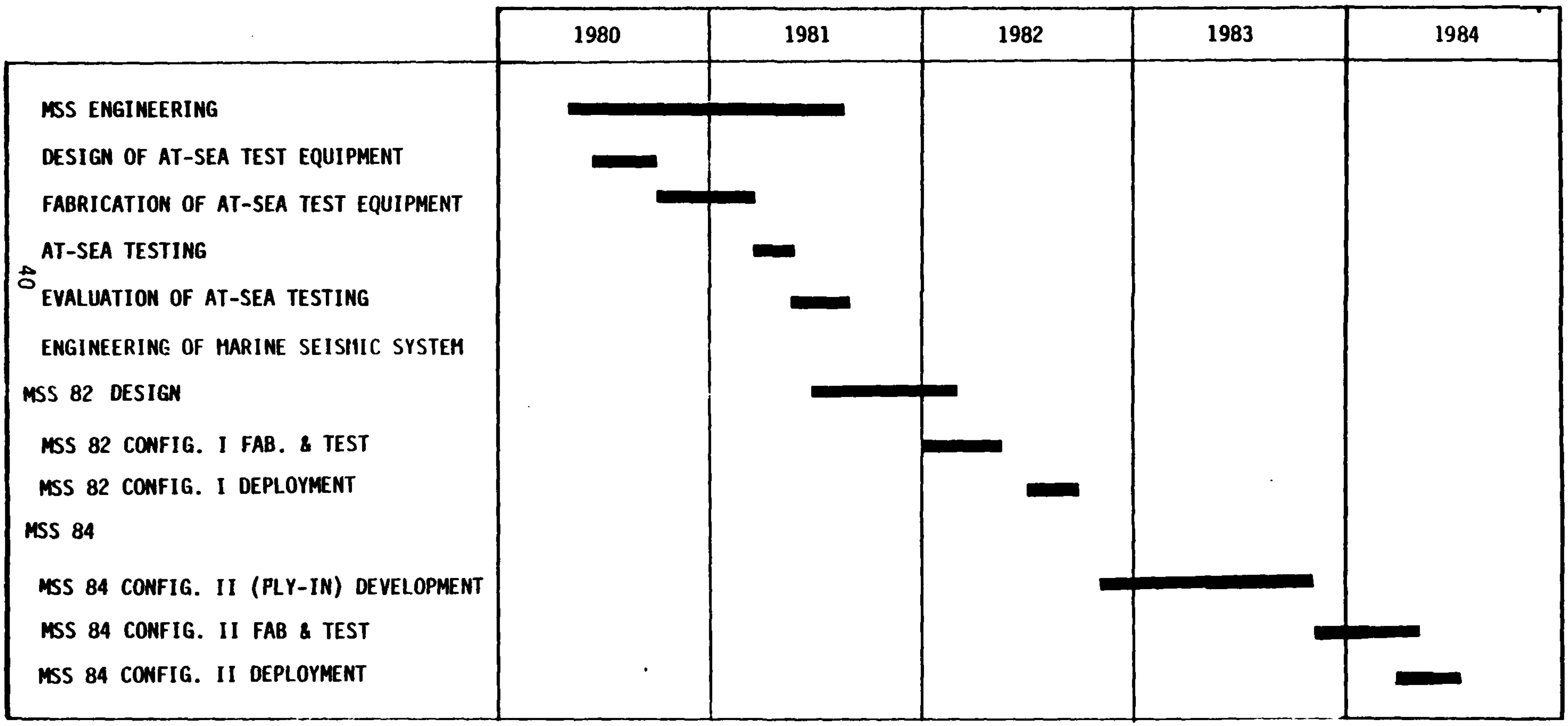

FIGURE 9-1 PROGRAM SCHEDULE

9913-074

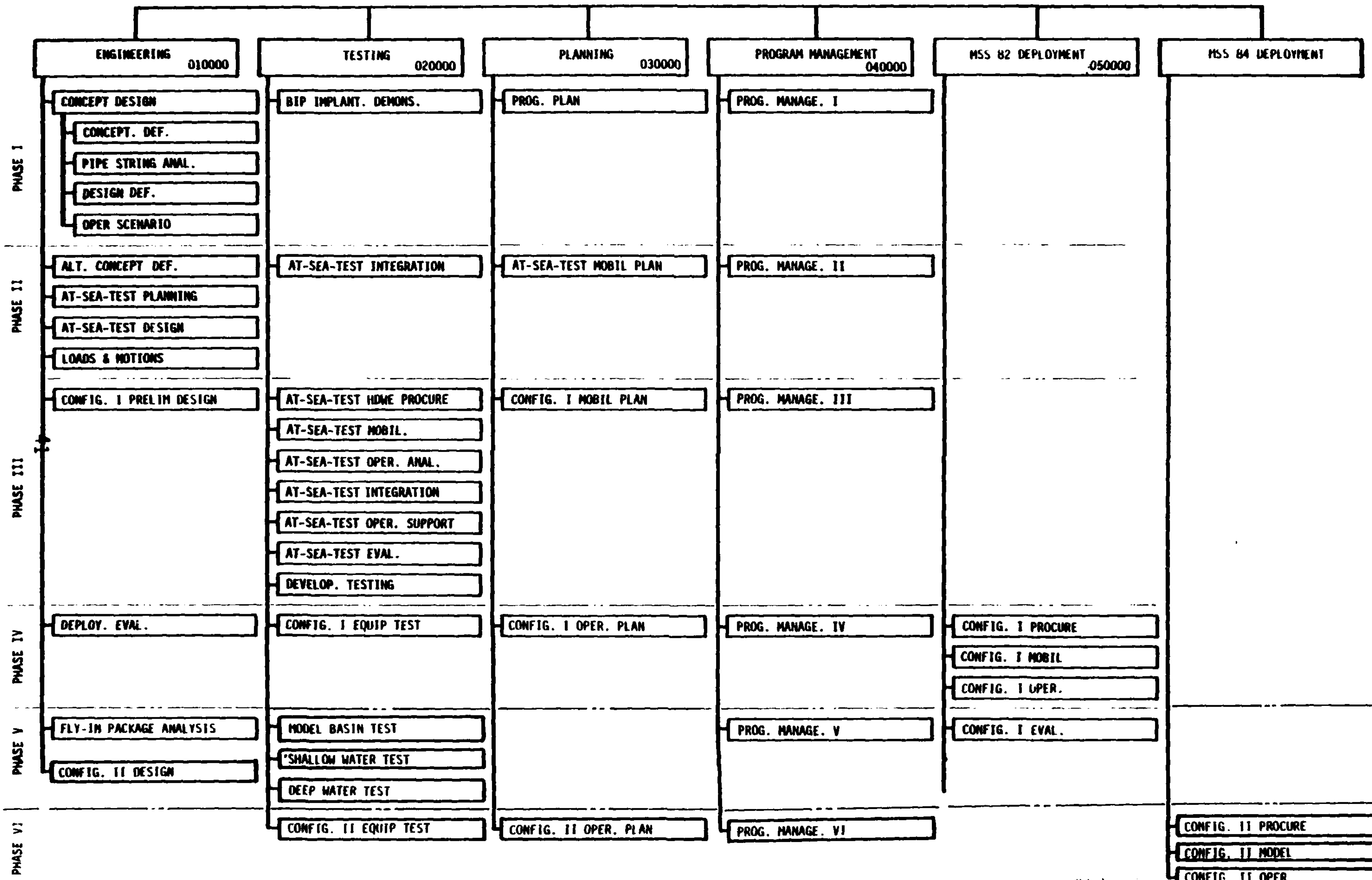

FIGURE 9-2 WORK BREAKDOWN STRUCTURE

9.3 PROGRAM ELEMENTS

The Phase I feasibility study essentially consisted of a conceptual design effort, and initial planning activity, plus a Rough Order of Magnitude (ROM) cost estimate. The Phase I report summarized the work accomplished to date in that phase and provided overall guidance for subsequent activities.

The Phase II effort concentrated on the design of equipment for the initial At-Sea-Test demonstration utilizing the Glomar Challenger. This activity started with the development of the necessary test criteria for both At-Sea and onshore development tests. Based upon this criteria, detailed designs for the baseline At-Sea-Test concept were prepared. The baseline design addresses reentry utilizing a drill pipe.

After review by NORDA, the final drawings and equipment specifications were released for vendor selection. In parallel, detailed planning for the At-Sea-Test was initiated including formulation of a fabrication, checkout, and mobilization plan. Detailed cost estimates for the At-Sea-Test equipment were prepared. In addition, a small analytical effort was undertaken to better determine the loads, motions, forces and pipe string stress levels for the drilling, casing installation and reentry operational subphases.

A limited alternate reentry concept evaluation assessed state-of-technology for deep ocean guideline and "Fly-In" deployment approaches. The "Fly-In" platform approach has been selected for further Configuration II design studies.

Phase III was initiated by the authorization to procure the necessary "At-Sea-Test" equipment. In addition, the detailed test operational procedures plus installation requirements were developed in conjunction with the DSDP Project Office and coordinated with NSF.

The actual MSS '81 At-Sea-Test occurred during late March of 1981. From this test, final verification data concerning impact loadings, cable entanglement and operational procedures are being developed. Overall planning for the MSS '82 deployment in the Northwest Pacific was initiated. The final design of the Configuration I deployment equipment has been undertaken. In parallel, the preliminary fabrication and mobilization planning for Configuration I deployment has been performed. Configuration I deployment equipment procurement cost estimates were also generated.

Phase IV covers the actual fabrication, assembly and checkout of the specialized MSS '82 Configuration I deployment equipment. The equipment will be shipped early to Japan for preinstallation checkout. Final Glomar Challenger mobilization and modification procedures will be established. In addition, the deployment operational procedures will be finalized in conjuction with the DSDP Project Office. At this time, the final safety reviews will also be presented.

The actual shipboard installation of equipment and the deployment of the MSS from the Glomar Challenger will then be undertaken. The entire operational segment should be accomplished within a two-month period including demobilization. A MSS '82 Configuration I deployment program report should be issued within three months after actual demonstration.

The development testing for the Configuration II "Fly-In" deployment equipment will be undertaken in Phase V. The objective is to coordinate and utilize the available technology now spread throughout various Navy, Scientific and Industrial organizations. The possibility of a simplified reentry demonstration during the 1983 operations will be assessed and undertaken if practical.

During Phase V a series of model basin plus shallow water (1,000 - 2,000 feet) will be performed to verify the analysis. The procurement of equipment for deployment of the Configuration II MSS

from a special surface support vessel will be accomplished. A reentry "Fly-In" package will be fabricated and tested preparatory to final mobilization. In addition, handling equipment such as EM winches, lowering winches, and constant tensioning equipment will need to be provided. The MSS '84 "Fly-In" Deployment is tentatively scheduled for July-August period of 1984 at the Northwest Pacific site. The special surface support vessel will need to be considerably modified to handle the lowering, positioning, and reentry equipment, plus deployment of mooring system and communication equipment activities.

SECTION 10.0 - MSS DEPLOYMENT PROGRAM COST EVALUATION

The overall MSS Deployment Program has been recosted in accordance with the presently defined baseline configuration. The costs are broken down by phases and by major activity.

10.1 COST PROJECTION

A preliminary cost estimate for the overall MSS Deployment Program has been updated and is presented in Table 10.1. The logistic support and mobilization cost are based upon similar field operations conducted by GMDI on other programs. The technical support projections (i.e., engineering, quality assurance, inspection, documentation, safety reviews, etc.) are consistent with a commercial type contract but are minimal for a typical government contract.

The cost summary has been organized into a matrix presentation to show costs by phase and by major activity. The Phase IV costs are derived from the revised Phase IV proposal (Reference 7) recently submitted to NORDA.

Cost actuals for the March 1981 At-Sea-Test reentry demonstration are presented in Table 10.2.

Rough Order of Magnitude (ROM) costs for the FY 1983 Configuration II deployment development are presented in Table 10.3. The full definition of objective and scope for the Configuration II deployment must await detail planning tasks.

TABLE 10.1

MSS DEPLOYMENT PROGRAM COST PROJECTION

	I Jan-June 1980	II Jun-Sept 1980	III** Oct-Sept 1981	IV Oct-Sept 1982	V*** Oct-Sept 1983	VI* Oct-Sept 1984	TOTAL
Engineering	$59,000	120,200	71,700	177,800	123,000	-	$551,770
Testing (including At-Sea-Test)	--	17,200	1,151,000	88,200	427,000	--	1,683,400
Planning	15,400	15,100	37,100	63,100	--	--	130,700
Program Management	11,200	35,900	108,800	147,900	65,000	--	368,800
Deployment - MSS '82 (Procure & Oper.)****	--	--	--	848,400	--	--	848,400
Deployment - MSS '84	--	--	--	--	--	--	--
TOTALS	$85,600	188,400	1,368,600	1,325,400	615,000	--	$3,583,000

*Configuration II deployment objectives and requirements have not been defined.
**Phase III Costs include development tests.
***Early ROM development intimate.

TABLE 10.2

AT-SEA-TEST DEMONSTRATION
MARCH 1981
(Excluding Program Management)

At-Sea-Test Equipment Design	$345,300
At-Sea-Test Equipment Procurement	369,300
At-Sea-Test Planning	21,800
At-Sea-Test Integration	86,400
At-Sea-Test Mobilization and Operations	348,200
Shore Testing	84,700
Evaluation	35,800
TOTAL	$1,291,500

NOTE: 1. Does not include any Glomar Challenger costs.

TABLE 10.3

CONFIGURATION I DEPLOYMENT SYSTEM INCLUDING DARS
PROCUREMENT AND LOGISTIC COSTS
(Excluding Program Management)

(1 Borehole - 1 BIP Reentry)	
Procurement and Support Services	$207,000
IRR Procurement Design	177,800
Operation Planning	63,100
Equipment Test	88,300
Mobilization and Demobilization	341,100
Operations	143,100
Integration	114,400
Evaluation Report	42,900
TOTAL	$1,177,700

*Does Not include costs of Glomar Challenger.

MSS PHASE III REFERENCES

1. Marine Seismic System Deployment Phase II, Report 001-003, dated 09 January 1981.

2. Marine Seismic System At-Sea-Test Report - Rpt 006-007 - Rev 0.

3. The Dynamics and Optimum Towing Strategies for Submersibles Paul A. S. Soler - MTS Sound, Volume 6, No. 2.

4. Geophysical Instrument Reentry - Dr S. Sergeo, CEL Preliminary Report.

5. On the Shape of a Cable Towed in a Circular Path, R. Skop, NRL 7048, 24 April 1970.

6. Configuration of a Towline Attached to a Vehicle Moving in a Circular Path, Choo and Casarella Journal of Hydronautics, Volume 6, No. 1, January 1972.

7. Phase IV MSS Deployment System Proposal 0581-12-035, 4 August 1981.

APPENDIX A

MSS '82 TEST PLAN SYNOPSIS

MSSA02-SYS-P001

REV 0

PLAN

MARINE SEISMIC SYSTEM PROGRAM

MSS 82 TEST PLAN SYNOPSIS

26 FEBRUARY 1982

APPROVED BY ______________________

NORDA

PREPARED BY:

GLOBAL MARINE DEVELOPMENT INC

2302 MARTIN STREET

IRVINE, CALIFORNIA 92715

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SECTION 1.0 - OBJECTIVES

The primary objective of MSS 82 is to provide a proof-of-principal demonstration for the deep water borehole seismic BIP (Borehole Instrumentation Package) concepts. Specific goals are:

- o Obtain Northwest Pacific site specific subseabed seismic data.
- o Demonstrate deep water BIP Seismic package within a borehole deployment.
- o Demonstrate deep water BPP (Bottom Processing Package) deployment using a IRR (Installation, Recovery and Reinstallation) System.
- o Verify DARS (Data Acquisition Recording System) seabed recording instrumentation capability.
- o Demonstrate IRR recovery effectiveness.
- o Deploy and recover HIG (Hawaii Institute of Geophysics) seismometer.
- o Deploy and recovery 9 OBS (Ocean Bottom Seismometer) units.

Short and mid-period seismic data from within a newly drilled borehole is to be provided over a 5-day real-time period and a 45-day recorded period to confirm subseabed installation effectiveness. Deep water BIP reentry into a borehole will be demonstrated utilizing the baseline concept which lowers the BIP at the end of a drill string. Subbottom vertical reflection survey, air gun seismic echo recording and slant range explosive testing is to be accomplished using an AGOR type Navy supplied support ship.

In conjunction with several OBS (Ocean Bottom Seismometric) units, a special HIG test seismometer will provide confirming data. The HIG Seismometer will be lowered down the drill string and deployed within an uncased borehole.

The BPP package, HIG Seismometer, plus the OBS units will be recovered 30-60 days later by a specially mobilized recovery operation. The BIP and EM cable will be left at the site.

Dynamic loads associated with deployment of the DARS and associated subsurface mooring equipment are to be recorded. The MSS '82 BIP may subsequently be replaced by a more advanced design instrument deployed by guided wireline techniques in 1984. Data relevant to this subsequent MSS '84 operation is to be obtained as a secondary objective.

SECTION 2.0 - ORGANIZATION RESPONSIBILITIES

The following responsibilities are:

Program Management	NORDA
Test System Integration & Technical Coordination	GMDI
Test Site Selection	NORDA/DSDP
Current Meter Measurements	NORDA
Support Ship - (Deployment)	NORDA
Support Ship - (Recovery)	NORDA
OBS & Explosives	NORDA
Reentry Deployment Equipment	GMDI
BIP Test Package	GEOTECH
Data Acquisition & Recording System (DARS)	GOULD
Pressure Vessels for DARS & Batteries	GOULD
EM Cable	GEOTECH
EM Winch	NORDA
Seismic & Acceleration Data Monitoring Equipment	GEOTECH
Challenger Modifications	GMDI/GMDC
Test Procedures	GMDI
Mobilization/Demobilization Logistic Support	GMDI
MSS Calibration Experiment	NORDA
IRR Mooring Hardware & Subsurface Buoy Design	NCEL
IRR Mooring Hardware & Subsurface Buoy Procurement	GMDI
BPP Structural Design	NCEL
BPP Fabrication and Assembly	GOULD
BPP Recovery & Redeployment	GMDI
HIG Seismic Package and Associated Equipment	HIG

SECTION 3.0 - SITE CHARACTERISTICS

The proposed tests will be accomplished in the North Pacific utilizing a new borehole and reentry cone to be installed by the Glomar Challenger as part of the Deep Sea Drilling Program (DSDP). One primary site, located at 45° 45'N, 162° 08'E and a secondary site, located 46° 45'N, 163°18'E, are under consideration. Typical characteristics of the proposed sites are:

- Water Depth: 5598 - 5650 M
- Sediment Depth 270 - 360 M
- Basalt Penetration Depth: 20 - 50 M

The sediment is a silico-calcareous clay with volcanic admixture.

3.1 BOREHOLE CHARACTERISTICS

The new DARPA site borehole will have a drilled out diameter of 10 inches to approximately 1,280 feet below the seabed including 100 feet into the basalt. There is a 16 inch diameter by 200 foot conductor casing in the upper unconsolidated sediment area. The central portion of the borehole will be cased down to approximately 1,180 feet with 11-3/4 inch casing. The bottom basalt region will not be cased. The HIG Seismometer will be installed in an uncased test core near the primary borehole.

3.2 REENTRY CONE

A standard DSDP reentry cone (Reference 2) with casing hanger and casing to basement will be emplaced. The upper reentry cone will be approximately 16 feet in diameter and 20 feet high.

3.3 DRILL STRING

A standard DSDP 5 inch diameter S-135 drill string is to be utilized. Maximum allowable load (static plus dynamic) is 600,000 pounds.

SECTION 4.0 - SCHEDULE

The proposed test will tentatively take place in late August - early September 1982 period during special MSS Challenger operation leg #88. The Challenger will depart Hakodate, Japan tentatively on 16 August 1982 and return to Yokohama, Japan on 15 September 1982. Total estimated site time of the Challenger is 19 days for the MSS Test. Figure 4-1 depicts the current overall schedule. The IRR recovery operation will be attempted between 1 October 1982 and 1 November 1982. An integrated test schedule will also be provided and updated twice monthly.

PAGE 4 OF 5

DATE 16 February 1982

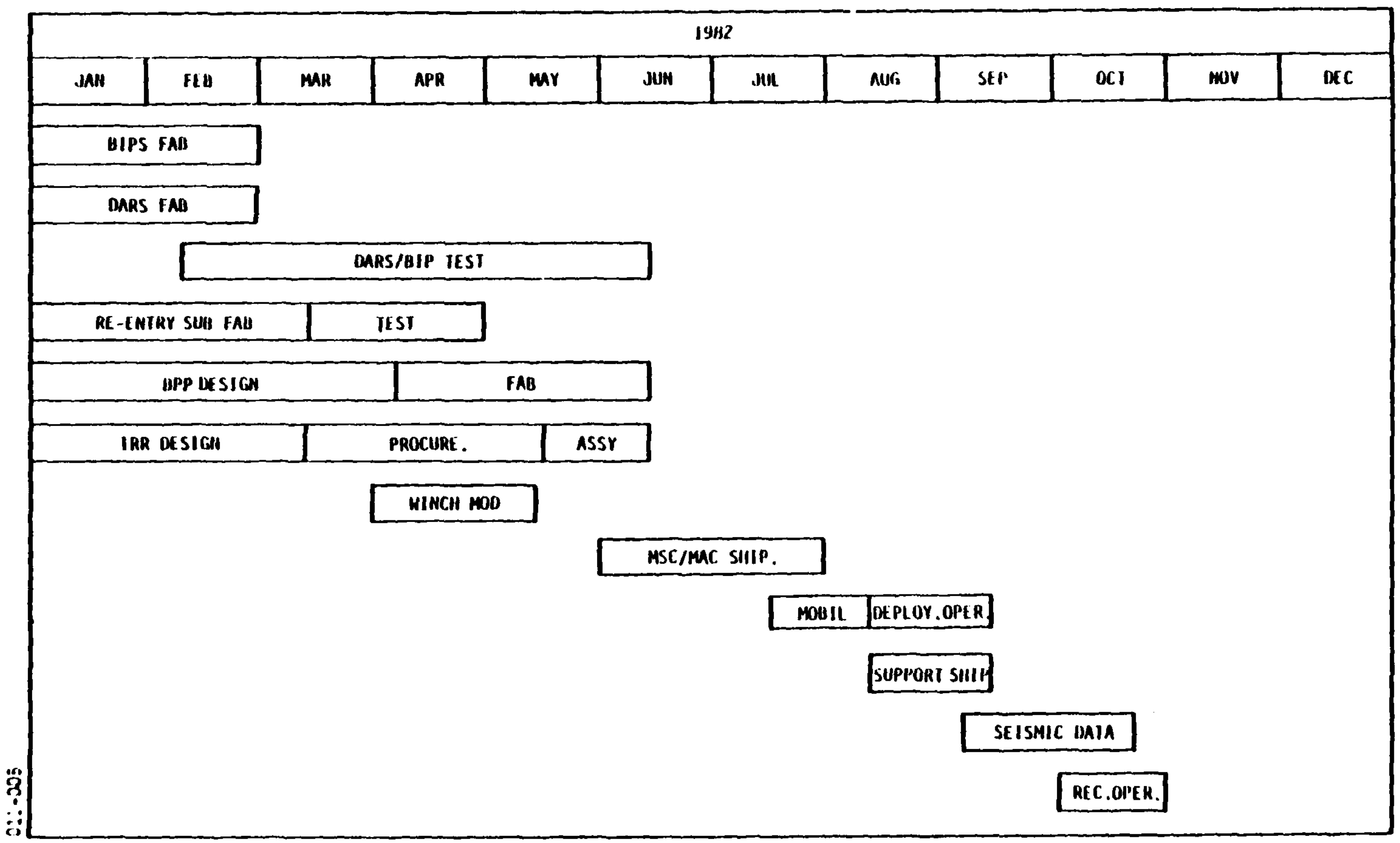

FIGURE 4-1 MSS (MARINE SEISMIC SYSTEM) '82 PROGRAM SCHEDULE

SECTION 5.0 - EQUIPMENT REQUIREMENTS

The following At-Sea-Test equipment has been defined for the baseline system.

BIP Lowered At End of Pipe (Baseline)	Responsibility	Remarks
BIP Reentry Test Packages (2)	GEOTECH	
EM Cable	GEOTECH	NORDA Supplied
Reentry Tool (Sonar & Readout Console)	DSDP	Onboard
Reentry Sub Includes 2 Impact Stingers, 1 Release Mechanism Reentry Sub Plus Control Manifold	GMDI	
BIP Recording Consol Van (STC)	GEOTECH	NORDA Supplied
BIP EM Cable Winch	NORDA	Navy Supplied
Challenger MSS Deployment Equipment	GMDI	
Reentry Cone & Casing	DSDP	
Deployable Current Meter or Shear Probes	NORDA	
OBS Seismic Packages	OSU & HIG	
ASK Beacons	DSDP	
BPP Package Incl. DARS and Batteries	GOULD	
IRR Mooring Cable & Subsurface Buoys	GMDI	
EM Cable	GEOTECH	
Underwater TV Camera	NORDA/GMDI	
DARS Checkout Console	GOULD	
HIG Seismic Package	HIG	
HIG Bottom Package and Recovery Equipment	HIG	
ATNAV System	NCEL	

SECTION 6.0 - TEST DATA

6.1 SEISMIC IN-HOLE DEMONSTRATION (120 HRS REAL-TIME)

- o 3-Channel Short-Period Seismic Sensor
- o 3-Channel Mid-Period Seismic Sensor
- o OBS Comparative Data (8 OBS units planned)
- o BIP State-of-Health Instrumentation:
  - 4 Temperature Sensors
  - 1 Pressure Transducer
  - 1 Input Voltage Monitor
  - 12 Regulated Voltage Monitors
  - 1 Reference Voltage Monitor
  - 1 Selectable Voltage Monitor
  - 3 Calibrator Voltage Monitors
  - 3 Digital Monitors, Including:
    1 Subframe Counter
    1 Command Arrival Time
    1 Master Status Word
  - 3 Digital Words to Recognize Feedback and Signal Clipping
  - 3 Spare Channels

6.2 DARS SEISMIC IN-HOLE DEMONSTRATION (45 DAYS RECORDED)

- o 3-Channel Short-Period Seismic Sensor
- o 3-Channel Mid-Period Seismic Sensor
- o OBS Comparative Data
- o State-of-Health Instrumentation:
  - 4 Leak Detectors
  - 2 Tilt Detectors
  - 4 Temperature Sensors
  - 1 Pressure Transducer
  - 1 Humidity Sensor
  - 1 Primary Battery Monitor
  - 4 Secondary Battery Monitors

- 9 DC/DC Power Monitors
- 2 ADC Status Monitors
- 4 Spare Channels
- 1 Hydro Acoustic
- 1 Real Time Clock

6.3 REENTRY DEMONSTRATION

- o Ship Stationkeeping Characteristics
- o Shock Impact
- o Current Profile with Depth
- o Cable Tension

6.4 LOWERING IN BOREHOLE DEMONSTRATION

- o Release BIP acceleration characteristics
- o BIP Lowering Velocity
- o Surface Cable Payout
- o Lowering Cable Tension

6.5 IRR DEPLOYMENT

- o Ship Stationkeeping Characteristics
- o ATNAV Control Characteristics
- o Cable Tension
- o *Challenger* Wave Response

6.6 IRR RECOVERY & REDEPLOYMENT

- o BIP Status
- o Cable Tension
- o HIG Seismic Package and 6 OBS Units
- o T-ATF Stationkeeping Characteristics
- o BPP Package (DARS)
- o ATNAV Control Characteristics
- o T-ATF Wave Response

SECTION 7.0 - SPECIAL CONSIDERATIONS

- The high strength drill string is an expensive and long lead procurement item. Present responsibility for the drill string lies with DSDP.

- Cementing the BIP into the borehole is not included.

- Severe weather and currents are typical in this general site area.

SECTION 8.0 - TEST PERSONNEL

Accommodations for At-Sea-Test personnel will be as follows in addition to 1 Co-Chief Scientist:

NORDA	1
GMDI	3
GEOTECH	3
GOULD	3
	10

SECTION 9.0 - SUPPORT VESSELS

One USN AGOR Desteiguer support vessel will be on station during the 19 day deployment period. A USN T-ATF fleeting will be utilized for the subsequent recovery of operation.

APPENDIX B

MSS '82 DEPLOYMENT SYSTEM INTERFACE AND REQUIREMENTS SPECIFICATION

MSSA02-SYS-S001
REV 0

SPECIFICATION
MARINE SEISMIC SYSTEM PROGRAM
MSS '82 AT-SEA-TEST
BASELINE DEPLOYMENT SYSTEM INTERFACE & REQUIREMENTS SPECIFICATION

INITIAL RELEASE

26 FEBRUARY 1982

PREPARED BY

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IRVINE, CALIFORNIA 92715

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AT-SEA-TEST BASELINE DEPLOYMENT SYSTEM REQUIREMENTS SPECIFICATION

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LIST OF TABLES

SECTION 1.0 - OBJECTIVES

The objective of this Interface Specification is to define the performance and interface requirements for the BIP test package, reentry equipment, Glomar Challenger equipment, STC, BPP, IRR mooring equipment, and IRR Recovery Ship Handling Equipment for the MSS '82 System demonstration. The deployment is to be performed at a new site in the Northwest Pacific utilizing the Glomar Challenger. Recovery and redeployment of the BPP will be accomplished off Navy supplied vessels.

SECTION 2.0 - REFERENCES

- MSS 82 Plan Synopsis dated February 1982
- Reentry Cone Assembly
- Glomar Challenger Plans (D-377-A002, -A003 & -A004)
- Reentry Assembly Control Dwg MSSA02-D002
- BIP/Reentry Sub with Stinger Control Dwg MSSA02-D001
- Challenger MSS At-Sea-Test Interface Dwg
- BIP Control Dwg 990-53100-0102
- BIP Assembly Dwg
- At-Sea-Test Mobilization Plan, GMDI Report
- MSS At-Sea-Test Operational Procedures, GMDI Report
- EM Cable Winch Dwg (Revised)
- BPP Assembly Dwg
- IRR Installation, Recovery and Reinstallation System Control Dwg

SECTION 3.0 - TEST OBJECTIVES

The test objectives are to:

- o Provide DARPA seismic borehole
- o Demonstrate the baseline BIP drill string deployment techniques in deep water
- o Measure seismic data within a deep sea borehole
- o Record 5 days of direct seismic data
- o Deploy the BPP and associated IRR mooring system
- o Record 45 days of seismic data (DARS)
- o Recover BPP and redeploy EM cable
- o Deploy HIG seismometer and associated recovery equipment
- o Recover HIG seismometer
- o Runover OBS units

SECTION 4.0 - GENERAL REQUIREMENTS

4.1 SITE

The proposed tests will be accomplished in the North Pacific utilizing a new borehole hole/reentry cone to be installed by the Challenger/DSDP. One primary site, located 45°41'N, 162°08'E and a secondary site, located 46°45'N, 163°18'E, are under consideration. Typical characteristics of the proposed sites are:

- Water Depth: 5,598 - 5,650M
- Sediment Depth: 270 - 360M
- Basalt Penetration Depth: 20 - 50M

The sediment is a silico-calcareous clay with volcanic admixture. Refer to Figure 4-1 for general topography of bottom.

4.2 BOREHOLE CHARACTERISTICS

The new site borehole will have a drilled out diameter of 10 inches to approximately 1,200 feet below the seabed including up to 150 feet into the basalt. There is a 16 inch diameter by 200 foot conductor casing in the upper unconsolidated sediment area. The central portion of the borehole will be cased down to approximately 1000 feet with 11-3/4 inch casing.

4.3 REENTRY CONE

A standard DSDP reentry cone with casing hanger will be emplaced. The upper reentry cone will be approximately 16 feet in diameter and 20 feet high. Refer to Figure 4-2 for general configuration. The cone will be modified to protect the EM Cable and support 2 ATNAV transponders.

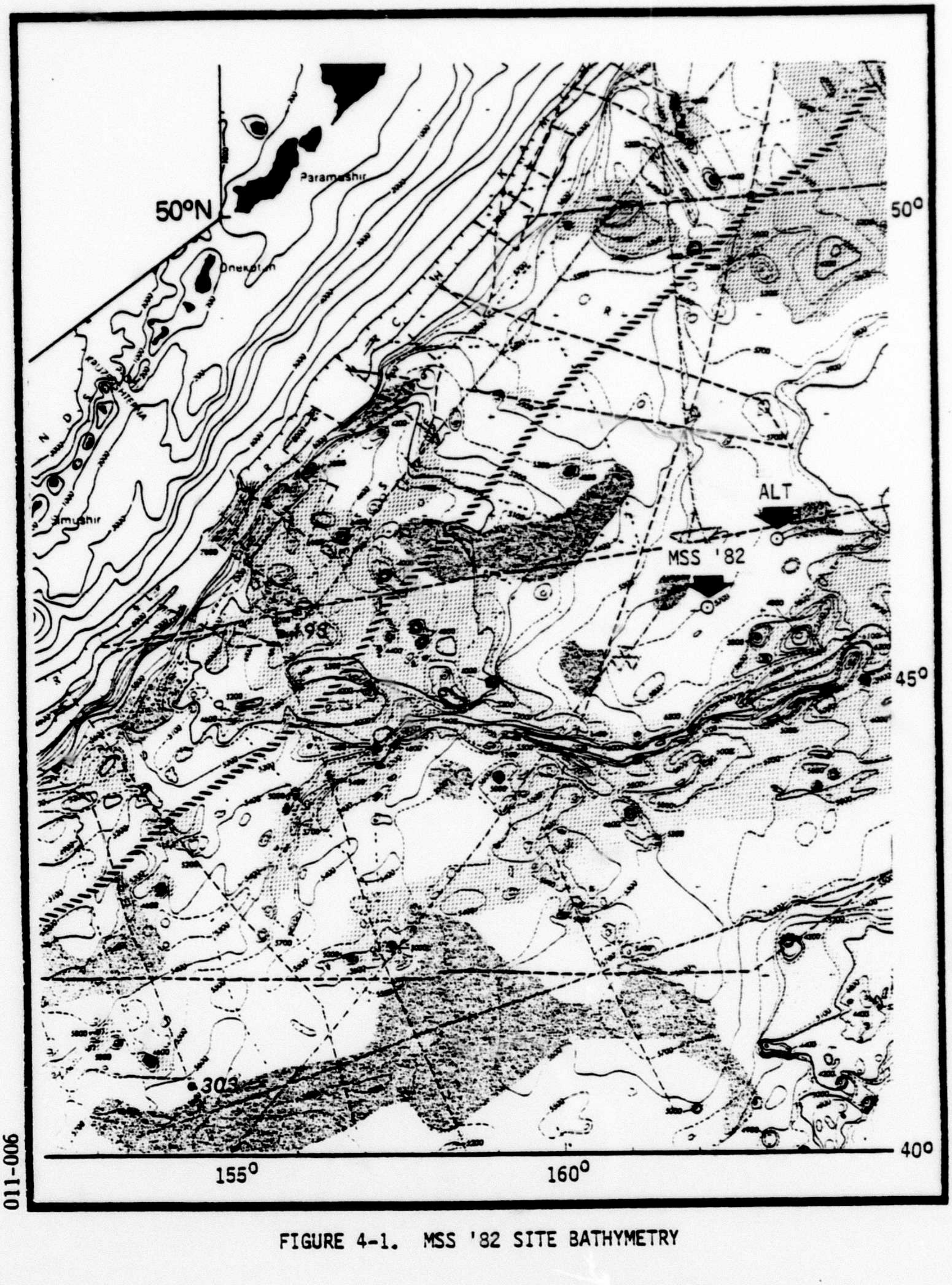


FIGURE 4-1. MSS '82 SITE BATHYMETRY

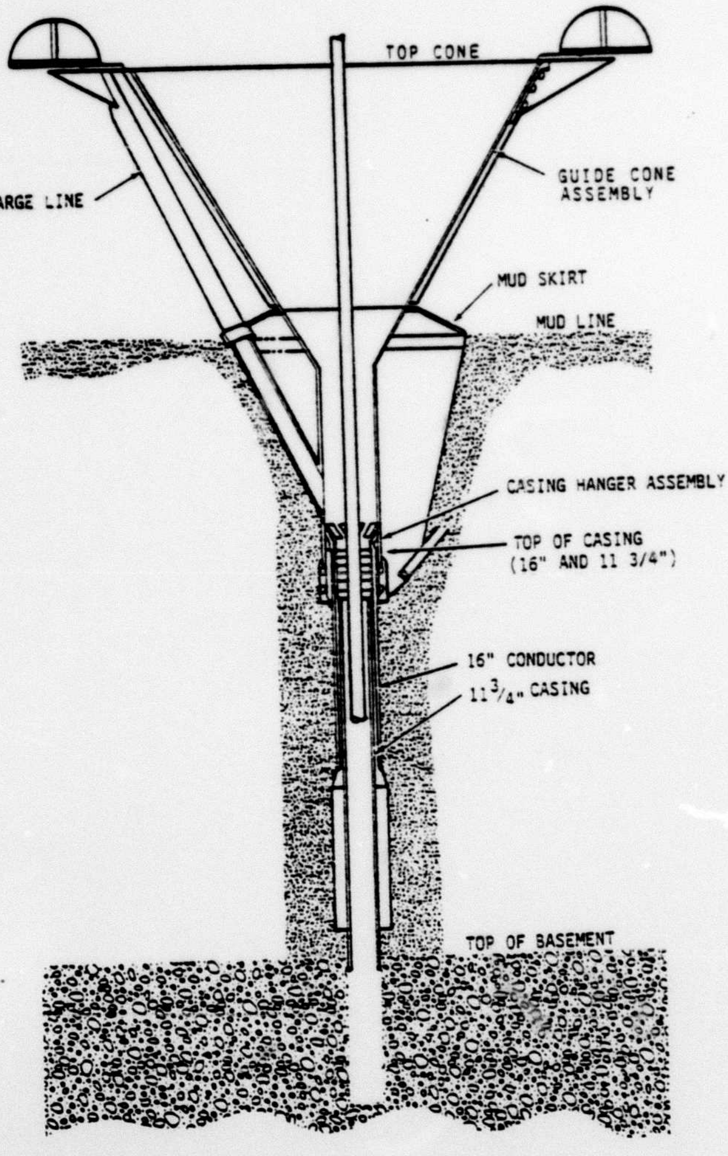


FIGURE 4-2 MSS 82 BOREHOLE/REENTRY CONE CONFIGURATION

0006-054

4.4 DRILL STRING

A standard DSDP 5 inch diameter S-135 drill string is to be utilized. Maximum allowable load (static plus dynamic) is 600,000 pounds.

4.5 REENTRY VELOCITY

The design maximum reentry velocity will be 10 ft/sec based upon a maximum lowering speed with the Hydromatic brake.

4.6 PRESSURE

Subsea equipment is to be designed to 10,000 psi pressure capability.

4.7 OPERATIONAL CRITERIA

Objective weather and operational criteria are tabulated on Table 4.1.

4.8 SITE WEATHER & SEA CONDITIONS (From NORDA Technical Report 31)

4.8.1 General Weather

Summer anticyclonic air circulation is controlled by a high pressure cell centered about 40°N, 150°W. Wind direction is synonymous with atmospheric circulation, whereas surface currents are generally caused by Ekman transport and geostrophic flow.

Paths for low pressure fronts generally move from southwest to northeast, slightly to the north of the proposed sites.

4.8.2 Winds

Projected maximum and typical wind conditions are tabulated on Table 4.2 and 4.3. Typical winds are from the Westerly direction.

TABLE 4.1

GLOMAR CHALLENGER

TENTATIVE MSS DEPLOYMENT LIMITS

	SEA STATE	SIGN. WAVE (FT)	WIND SPEED (KNOTS)
HANDLING MODE	5	12	24
DRILLING MODE	6	22	30
REENTRY MODE	4	17	19
POSITIONING	7	?	40
KEELHAULING	3	4	.19

ULTIMATE PITCH/ROLL ANGLE $\pm 9^{o}$

SAFETY PITCH/ROLL ANGLE $\pm 7^{o}$ (NEW DSDP CRITERIA)

DRILL STRING TENSILE LOAD 600,000 LBS (22,500 FT PIPE STRING - CALM)

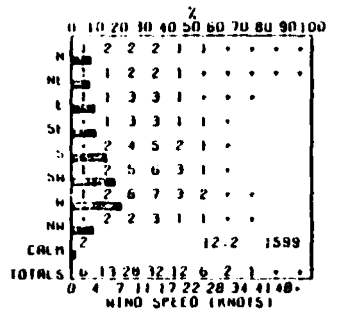
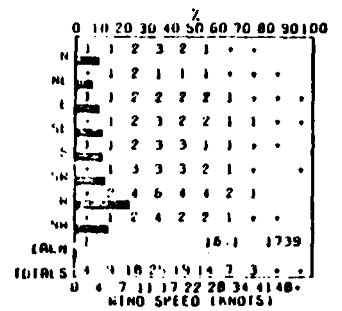
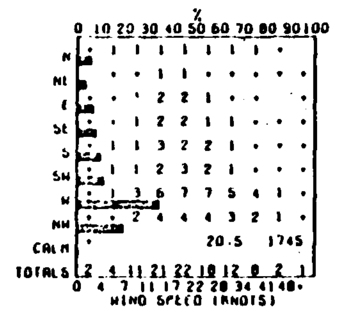
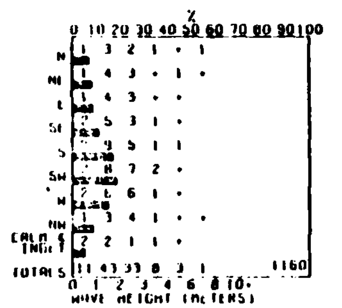
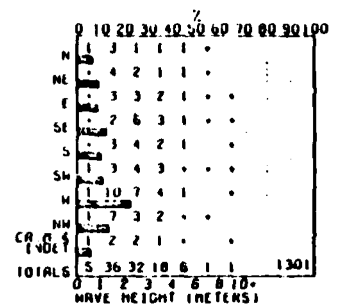
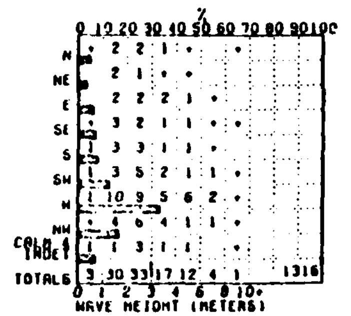
MAXIMUM BENDING STRESS (25,000 PSI)

MAXIMUM DYNAMIC AXIAL STRESS (17,000 PSI)

TABLE 4.2

WIND AND WAVE CLIMATIC DATA FOR MSS DRILL SITE
(162° 08'E, 45° 41'N)

47–49°N, 161–164°E

	AUG	SEPT	OCT
WIND DIRECTION AND SPEED			
WAVE DIRECTION AND HEIGHT			
TROPICAL CYCLONE CHARAC-TERISTICS	65 CONSTANCY - 12 HR VECTOR RESULTANT MEAN STORM SPEED DIVIDED BY 12 HR SCALAR MEAN SPEED AND MULTIPLIED BY 100 A MEASURE OF CONFIDENCE IN DIRECTIONAL PERSISTENCE. .01 AVERAGE NUMBER OF TROPICAL CYCLONES PER 5° SQUARE FOR THE PERIOD OF RECORD.	99 .02	99 .03

REFERENCE: U.S. NAVY MARINE CLIMATIC ATLAS OF THE WORLD, VOL. II, NORTH PACIFIC OCEAN REVISED 1977 NAVAIR 50–1C–529

TABLE 4.3

MSS '82 WEATHER SUMMARY

I. DEPLOYMENT PERIOD (AUGUST PERIOD)

Probability of Exceeding:	4 FT Wave 85%
	8 FT Wave 30%
	12 FT Wave 10%
	16 FT Wave 3%
	20 FT Wave 2%

Typical Conditions Sea State 4 or Less.

Predominant Winds Below 24 Knots.

II. RECOVERY PERIOD (OCTOBER PERIOD)

Probability of Exceeding:	4 FT Wave 95%
	8 FT Wave 50%
	12 FT Wave 20%
	20 FT Wave 5%

Typical Conditions Sea State 5 or less.

Predominant Winds Below 36 Knots.

4.8.3 **Waves**

Projected maximum and typical wave conditions are tabulated on Table 4.2 and 4.3. Predominate waves are from the Westerly direction.

4.8.4 **Surface Currents**

The site lies within the eastward flowing warm water of the Kuroshio currents and southward flowing Kamchatka (Oyashiro) current. General surface currents during summer are shown by Figure 4-3. Maximum expected surface current is 0.5 knots, with a maximum projected current of 2 knots. Table 4.4 lists the design current 2 profile. Current direction is typically from the Northwest.

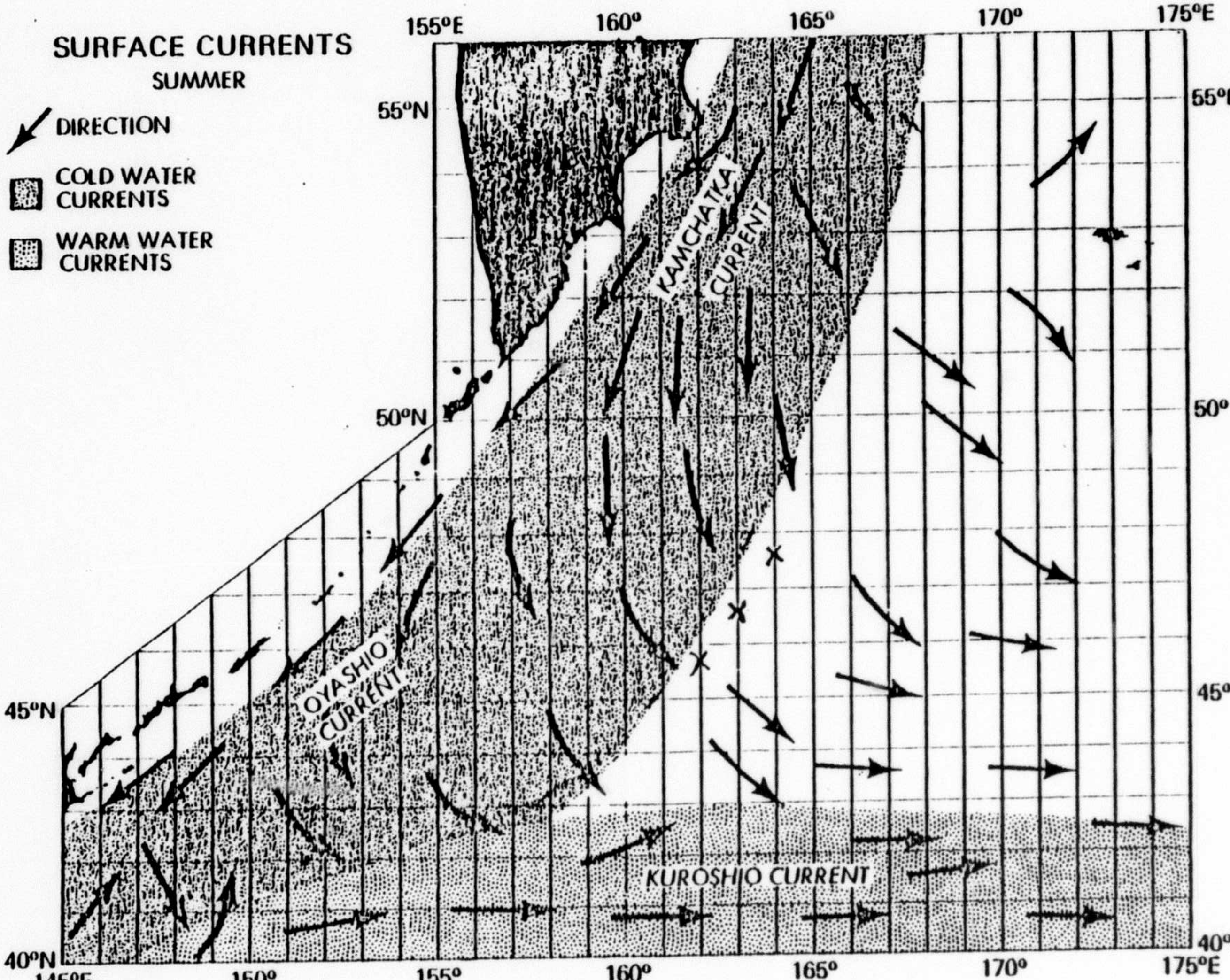


FIGURE 4-3 SITE SURFACE CURRENTS

0006-055

TABLE 4.4

DESIGN CURRENT 2 PROFILE

NORTHWEST PACIFIC SITE	CURRENT PROJECTION
100 METERS	2.0 KNOTS
300 METERS	0.4 KNOTS
1,000 METERS	0.2 KNOTS
3,000 METERS	0.1 KNOTS
3,000 METERS	0.1 KNOTS

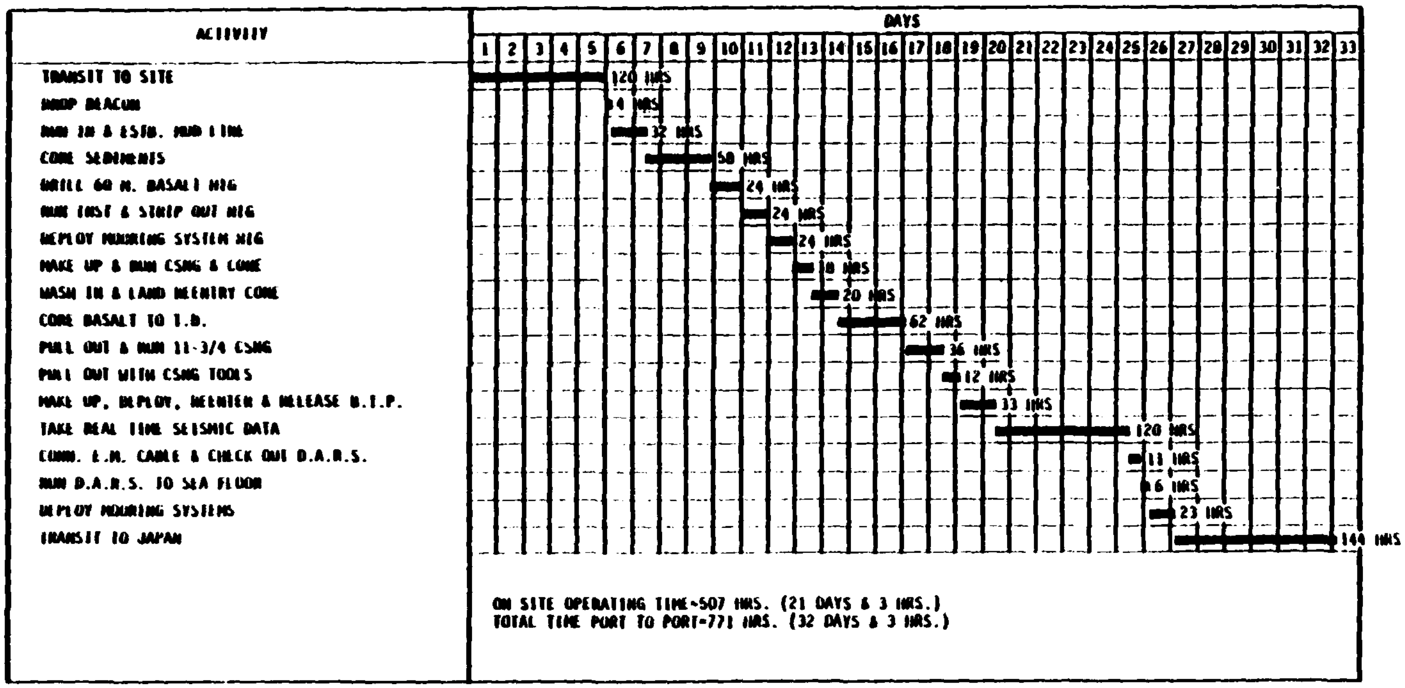
SECTION 5.0 - SCHEDULE REQUIREMENTS

5.1 TEST PERIOD

The deployment and test period will begion in late August 1982 and extend through early September 1982. The Challenger is scheduled to leave port on 15 August 1982. The initial recovery and redeployment period will be during the October 1982 period.

5.2 TEST TIME

The available time scheduled for actual MSS operations is 30 days. The tentative test scenario is now 19 days which must allow for weather delays or major malfunctions. As many as five days of in-hole continuously sampled and recorded seismic data will be obtained prior to deployment of BPP/DARS equipment. Figure 5-1 depicts the projected on site activity time allotments.



011-007

FIGURE 5-1. MSS '82 PROJECTED OPERATIONAL MILESTONES (CHALLENGER)

SECTION 6.0 - BIP TEST PACKAGE

6.1 CONFIGURATION

The BIP test package will be 8 inches diameter maximum by 34-1/2 feet long. The package will have a spherical shaped bottom nose. GEOTECH drawing Figure 6-1 defines the general outline of the BIP test package. Two screwed-in attachment plugs are available for shipboard handling.

6.2 WEIGHT

The maximum weight of the test package will be 3,300 pounds. This weight includes fairings, pressure vessels and all instrumentation and ballast.

6.3 POWER

Input power requirements will be 25 W at 150 VDC.

6.4 EM CABLE TERMINATION

A watertight termination compatible with an armored coax conductor cable will be utilized. The mechanical connector will be a pinned connection. The electrical terminal is a watertight connection. A sealant will be provided in the termination area.

6.5 INSTRUMENTS

The following instruments will be provided in the BIP:

- 3-Channel Short Period Seismic Sensor
- 3-Channel Mid-Period Seismic Sensor
- Back-up (Vertical) Short Period Sensor
- State-of-Health Instrumentation
- 3-Channel Acceleration Sensor

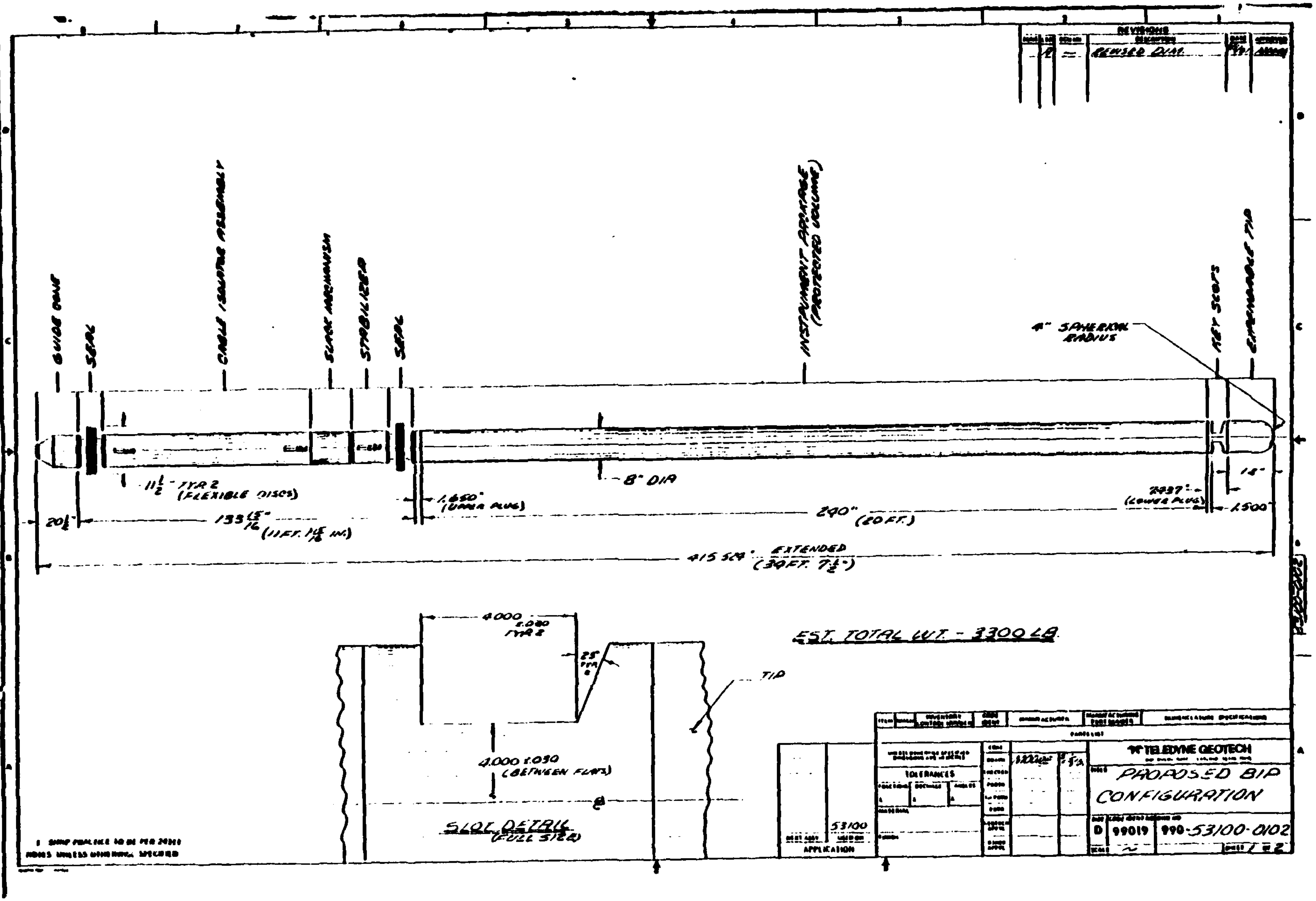


FIGURE 6-1 PROPOSED BIP CONFIGURATION

6.6 DATA MONITORING

To be supplied at a later date.

6.7 EM CABLE

The BIP EM Cable will be a specially constructed 0.692 inch diameter armored coax cable. Approximately 30,000 feet are to be provided. This allows for current, stationkeeping allowance, plus slacking off during data recording. Refer to Figure 6-2 for design data on the cable.

6.8 SHOCK CAPABILITY

The BIP will be capable of surviving 10 G's of shock input imposed along any axis.

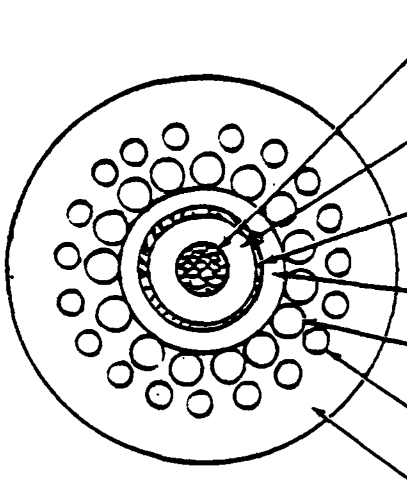
LOCKOUT DEVICE

The BIP will employ 3 borehole devices released when the BIP cable tension is below 1,500 pounds. The lockout devices will extend out to a maximum radius of 5.5 inches.

6.9 LOCKOUT DEVICE

The BIP will employ three lockout devices released when the BIP cable tension is below 1,500 pounds. The lockout devices will extend ou to a maximum radius of 5.5 inches.

A SUBMARINE TOW CABLE CONSISTING OF (10) #10 AWG COAX WITH AN OVERALL DOUBLE-CAGED ARMOR AND HYTREL JACKET.



<u>ELECTRICAL</u>:	NOM CONDUCTOR DC RESISTANCE @ 20°C:	@10 AWG:	1.08 OHMS/KFT
		COAX RETURN BRAID:	1.40 OHMS/KFT
	VOLTAGE RATING:		2,500 VOLTS RMS
	CHARACTERISTIC IMPENDANCE:		40 OHMS (REF)
	ATTENUATION AT 500 KC:		1.4 DB/KFT
<u>MECHANICAL</u>:	FILLED SHIELD:		TEMPLUBE BLKNG COMPOUND.
	BREAK STRENGTH:		21,000#
	WEIGHT IN AIR:		462 #/KFT
	WEIGHT IN WATER (SG = 1.027)		295 #/KFT
	TORQUE BALANCED DESIGN		

FIGURE 6-2 MSS EM CABLE

SECTION 7.0 - DEPLOYMENT EQUIPMENT

7.1 BIP REENTRY SUB

7.1.1 Configuration

The reentry sub will be an approximate 16 by 27 inch by 73 foot long subassembly. Drawing MSSA02-D002 defines the reentry sub.

7.1.2 Weight

The BIP reentry sub plus BIP package will weigh a maximum of 24,000 pounds.

7.1.3 BIP Attachment

The BIP will be securely attached by a BIP carriage inside the reentry sub.

7.1.4 BIP Release Mechanism

A BIP release mechanism will be provided as part of the reentry sub. The BIP will be released by salt water hydraulic actuation of 2 cylinders. Four shear pins are simultaneously released causing the carriage to move to the reentry sub center release position.

7.1.5 BIP Lowering

The BIP will be guided into the center of reentry sub and lowered into the borehole at a controlled rate, not to exceed 20 ft/min. The lowered position is to be monitored.

7.1.6 Drill Pipe Attachment

The reentry sub will attach through a standard tool joint to the 5 inch drill string bottom hole assembly as shown by Fig MSSA02-D001.

7.1.7 Shock Capability

The reentry sub will be designed to withstand the shock loads during reentry for maximum of 24 G's. In addition, shock isolation for the BIP will be provided to limit shock loading to 10 G's.

7.1.8 Data Monitoring

The reentry impact data will be monitored and recorded as real time during the reentry.

7.1.9 Cable Interference

The reentry sub will be designed to prevent wear on the EM Cable during lowering and avoid contact during withdrawal.

7.2 SONAR REENTRY TOOL & EM CABLE

7.2.1 Reentry Tool

The reentry tool will be the existing Glomar Challenger on-board sonar reentry tool.

The following measurements are provided:

- o Search Sonar - Maximum 500 foot Range - 360° Azimuth
- o Azimuth Sector
- o Short Range Scanning

7.2.2 Cable Configuration

The sonar reentry tool EM Cable will be a standard Schlumberger 5/8 inch diameter by 7 inch, conductor cable.

7.2.3 Cable Strength

Maximum cable tensile strength is 21,000 pounds.

7.3 EM CABLE WINCH

7.3.1 Capability

An EM Cable winch with slip rings will be provided to accommodate 30,000 feet of 0.692 inch coax cable on the storage reel. 500 feet of inch wire rope, 23,000 feet of 1 1/2 inch diameter polyester braided line and 28,000 feet of 7/8 inch polyester braided line will also be run through the winch.

7.3.2 Tensioning Capability

A variable constant EM Cable tensioning capability of up to 15,000 pounds continuous, 20,000 pound maximum, is to be provided.

7.3.3 Payout Capability

A variable speed payout capability up to 20 feet per second is to be provided.

7.3.4 Monitoring

Cable tension and payout length is to be provided.

7.3.5 Structure Mounting

The winch 8 inch by 6 inch steel tubing frame will be welded directly to the special ship mounted foundation piece.

7.3.6 Size and Weight

The Pengo EM Cable Winch will be approximately 110 inches high, 91 inches wide with an overall length of 232 inches. A clearance of 30 inches on the right hand side is required for slip rings and hydraulic motor. It will weigh an approximate 38,000 pounds loaded with wire.

7.3.7 Cable/Line Capabilities

The EM winch will be designed to accommodate the EM cable, 1-1/2 inch wire cable , 1-1/2 inch power braid and 7/8" power braid.

7.3.8 EM Cable Interconnection

The EM Cable will be terminated into a separate interconnection to the winch slip rings.

7.4 OVERSIDE A-FRAME STRUCTURE

7.4.1 Size and Configuration

A removable 28 foot long cantilevered A-Frame extends approximately 18 feet over the port side. The A-Frame is rated for 20,000 pounds load. The A-Frame is supported off the casing rack and subbase structure and by a center mounted heave compensator.

7.4.2 Deployment

The A-Frame is to be deployed overside during the test.

7.4.3 A Frame Sheave

An approximate 30 inch diameter snatch block will be provided at the outboard and of the A Frame. A manually operated guide rail trolley will be provided for inboard servicing of the A Frame sheave.

7.5 DYNAMIC TENSIONING EQUIPMENT

7.5.1 Description

A passive heave compensation system will be attached to the cantilevered A-Frame to reduce the dynamic EM Cable loading.

7.5.2 <u>Equipment</u>

A refurbished air/oil guideline tensioner will be utilized to provide a variable stroke support to the A-Frame. The 5 inch diameter by 6 foot stroke tensioner is rated at 64,000 pounds. Two accumulator will be utilized. High pressure air from the *Challenger* will be piped to the manifold console.

7.5.3 <u>Operation</u>

An approximate mid-position will be established by the normal static loading condition and gas pressurization levels. Increased/decreased dynamic loadings will lower/raise the A-Frame end position thereby effectively paying-out or pulling-in more cable.

7.6 SHIPBOARD TEST CONSOLE (STC)

7.6.1 <u>Size and Weight</u>

The STC will be 8 feet by 8 feet by 14 feet. It will weigh an estimated 9,000 pounds loaded.

7.6.2 <u>Shipboard Mounting</u>

The STC shall be welded to the deck on four short vertical foundation channels.

7.6.3 <u>Construction</u>

The STC shall be constructed so as to be completely watertight. All inside and outside wall, ceiling and floor spares shall be metal or high strength glass. Interior walls and/or components shall be constructed of fireproof material.

7.6.4 Electrical Interface

The STC to ship's electrical interface shall include the following interface signals:

- STC Input Power
- Voice Communications
- Universal Standard Time (WWV) Signal

Electrical output plugs will be provided for the DARS as follows:

- Strip Chart Recorder
- WWV Single
- Coaxial Cable
- Communications

7.6.5 STC Input Power

The input power capability will be 60 cycle 12 kW 208 VAC, 3 Phase, 4 wire, WYE connected with safety ground.

SECTION 8.0 - IRR SUBSYSTEM

8.1 BPP BOTTOM PACKAGE

8.1.1 Sled Dimensions

The BPP bottom package will be approximately 8 feet by 8 feet by 7 feet high. Figure 8-1 depicts the typical configuration.

8.1.2 Spheres

The BPP WILL SUPPORT 3 OBS type aluminum spheres each 40.5 inch in diameter. The spheres will be rated for 20,000 foot depth capability.

8.1.3 DARS

The DARS electronic recording package will be mounted within one sphere. Figure 8-2 depicts the schematic of the DARS electronic network.

8.1.4 Batteries

The cell silver zinc batteries will be installed in two spheres.

8.1.5 Weight

The BPP will weigh 8,400 pounds dry and 4,000 pounds wet.

8.1.6 Bottom SKirt

A 12 inch mud skirt will be used to stabilize the BPP in the surface sediment.

8.1.7 EM Cable Termination

The EM Cable will be mechanically terminated near the bottom of the BPP package on a pivoted arm.

FIGURE 8.1

BPP CONFIGURATION DRAWING

(NOT AVAILABLE)

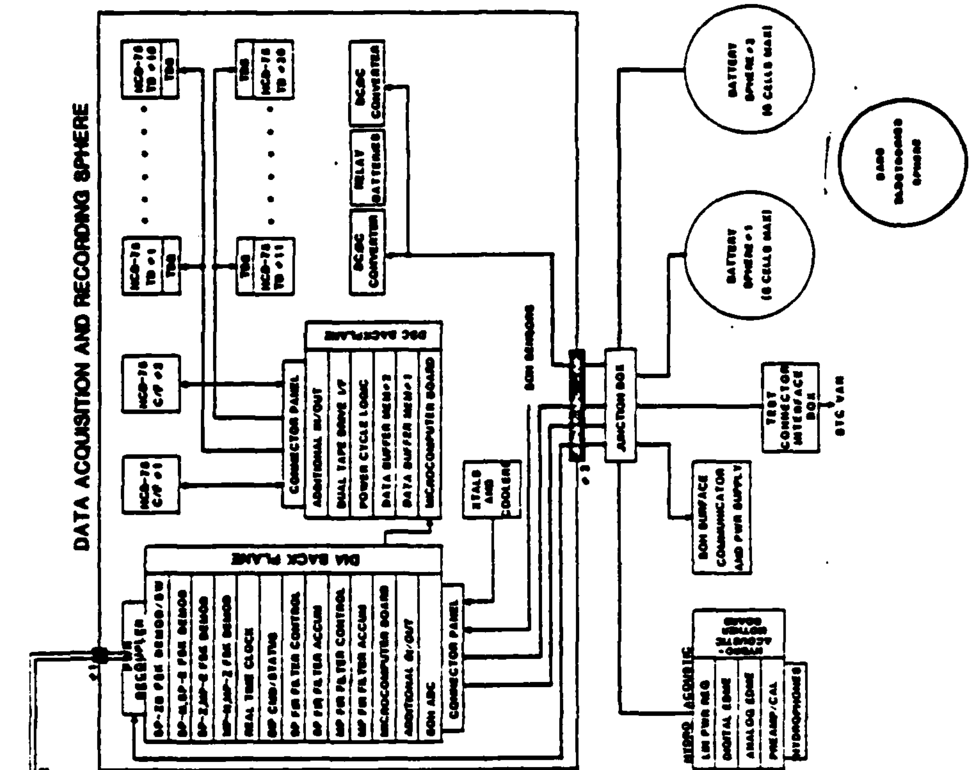


FIGURE 8-2 MSS '82 DARS SCHEMATIC

8.1.8 Lift Eye

A permanent lift dual eye at the center top of the BPP will be provided for the mooring line and shipboard handling crane.

8.2 IRR MOORING/RECOVERY SYSTEM

8.2.1 Configuration

Figure 8-3 depicts the entire IRR system.

8.2.2 Weight Characteristics

Table 8.1 presents a dry and wet weight estimate of the system.

8.2.3 Strain Relief Cable

A strain relief cable attached to the EM Cable will be provided to hold off the EM Cable during BPP servicing.

TABLE 8.1

IRR SYSTEM WEIGHT ESTIMATE

	WEIGHT-LBS		REMARKS
	DRY	WET	
BPP	8,500	4,000	8 x 8 x 7 FT SLED.
SWIVEL (BPP)	25	20	
WIRE CABLE	847	745	500 FT - 1 IN. WIRE ROPE.
STRAIN RELIEF CABLE	200	176	300 FT - 5/8 IN. WIRE ROPE.
LIFTING LINE	12,196	-720 TO -460	23,000 FT - 1-1/2 IN. POWER BRAID
A CROWN BUOY	372	-446	8 - 17 IN. DIA GLASS SPHERE BUOYS WITH HARD HAT
A FLASHER/REFLECTOR	15	-4	1 - WITH HARD HAT
A BUOY PENDANT	11	8	5 - 15 FT OF 1/2 IN. POWER BRAID
B CROWN BUOYS	465	-555	10 - 77 IN. DIA GLASS BUOYS WITHHARD HAT
B FLASHER/REFLECTOR	15	-4	1 - WITH HARD HAT
B BUOY PENDANTS	13	10	6 - 15 FT OF 1/2 IN. POWER BRAID
GRAPNEL LINE	1973	-17 TO -72	10,000 FT - 7/8 IN. POWER BRAID
DUAL ACOUSTIC RELEASE	30	20	
ANCHOR LINE	3548	-31 TO -131	18,000 FT - 7/8 IN. POWER BRAID
SWIVEL (ANCHOR CLUMP)	5	4	
CHAIN & SHACKLES	30	27	10 FT - 1/2 IN. CHAIN
CLUMP ANCHOR	1,800	1,584	STEEL BALL

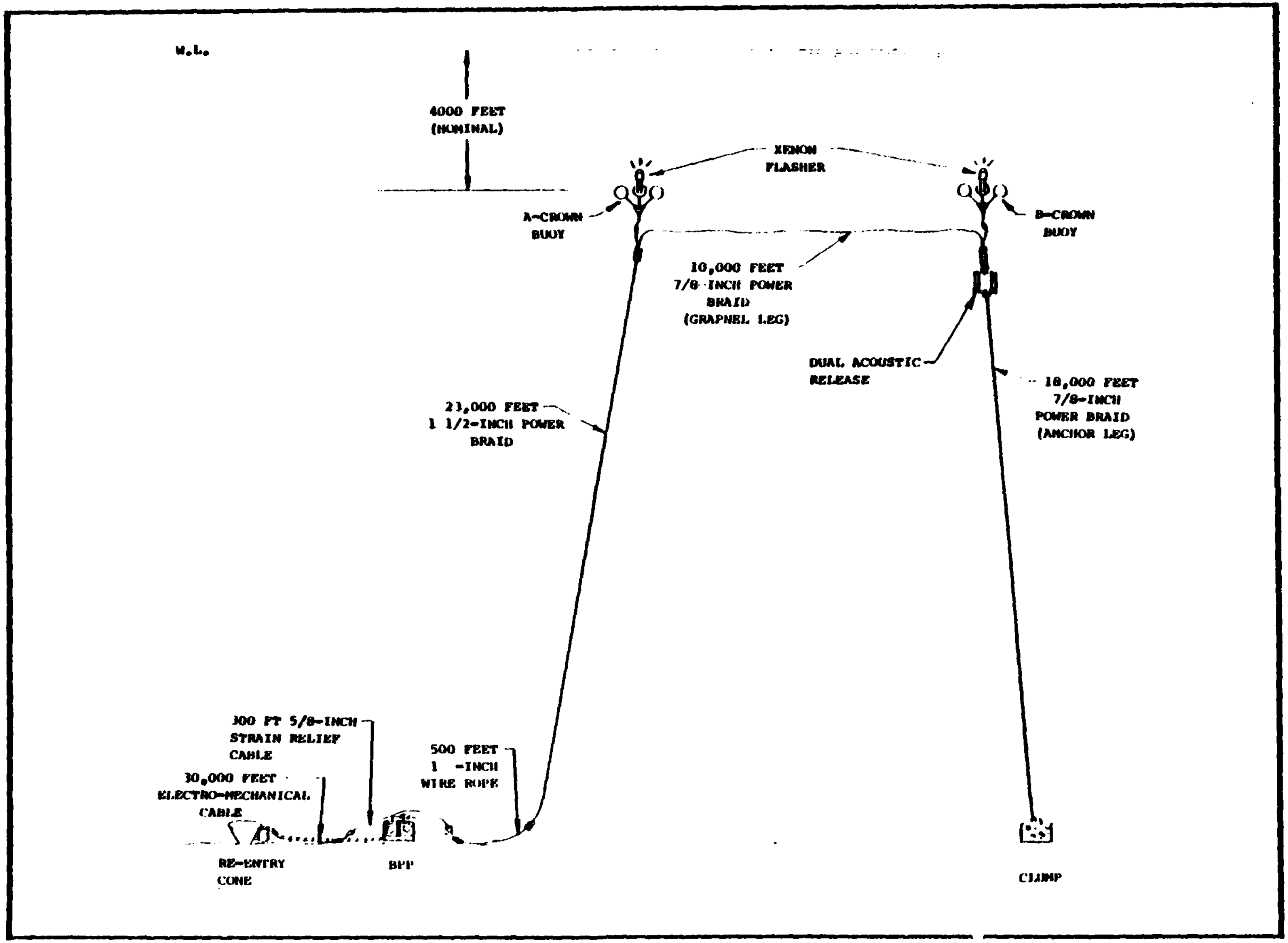


FIGURE 8-3 MSS '82 IRR INSTALLATION, RECOVERY & REINSTALLATION SYSTEM

SECTION 9.0 - CHALLENGER MODIFICATION

9.1 GENERAL REQUIREMENTS

The below defined equipment installations are to be quickly accomplished in port and must be capable of being retrofitted to original condition.

9.2 EM CABLE WINCH

Install on main deck area a diesel powered 34,000 foot EM Cable winch assembly.

9.3 A-FRAME

Install an approximate 10 ton overside A-Frame deployable structure amidships on the port side.

9.4 BIP DATA CONSOLE VAN (STC)

Install a real time data log and recorder van. Provide 12 kVA, 220/440 V, 3-Phase, 60 Hz, ship's power to van. Also, interconnect with ship's communication network.

9.5 BIP

A horizontal rack for 2 BIP units is to be provided in the casing rack area.

9.6 REENTRY SUB

A rack for 1 reentry sub including 2 stingers will be provided.

9.7 BPP

Space in the tween decks storage area is to be provided for maintenance of the BPP subsea bottom package. Temporary space on the port side casing main deck area is required for final deployment.

9.8 IRR MOORING LINE

Space for 51,000 feet of 1 1/2 and 7/8 inch diameter synthetic mooring line is to be provided on main deck near EM winch.

9.9 IRR SUBSURFACE BUOYS

Space for several IRR mooring subsurface buoys is to be provided on port side main deck area forward of house.

9.10 DARS CHECKOUT CONSOLE

A 7 conductor temporary communications cable is to be run from the STC van to the tween deck test area and the port main deck final checkout area. Cable requirements are:

1	-	EM Cable Signal	RG582/U Coax
2	-	Strip Chart Recorder	#20 AWG Twisted Pair
2	-	Voice Communications	
2	-	WWV Audito Signal	#20 AWG Twisted Pair

Power requirements in the tween deck area will be 220 volt single phase 50 amp circuit.

SECTION 10.0 - AUXILIARY MEASUREMENT

10.1 CURRENT METER ARRAY

A full depth readout capability current meter is desired from the support ship during the reentry tests. Current data will be provided to the *Glomar Challenger* via radio-telephone from the support ship.

10.2 OCEAN BOTTOM SEISMIC PACKAGE (OBS)

The OBS packages will be launched during the test and recovery by the support ship.

SECTION 11.0 - SUPPORT SHIP

11.1 INITIAL DEPLOYMENT

An AGOR type research vessel has been tentatively committed as the support ship.

11.2 RECOVERY AND REDEPLOYMENT

A Navy FATF fleet tug is tentatively assigned for the initial recovery operation.

APPENDIX C

MARINE SEISMIC SYSTEM

MSS 82 AT-SEA-TEST DEPLOYMENT

PRELIMINARY OPERATIONAL PROCEDURES

MSSA02-SYS-P002

REV-A

MAR 82

MARINE SEISMIC SYSTEM
MSS 82 AT-SEA-TEST DEPLOYMENT
PRELIMINARY OPERATIONAL PROCEDURES

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1.0 PRE-OPERATIONAL CHECKS

1.1 EM WINCH PRE-CHECKEDOUT (DOCKSIDE)

.1 Steps

- Rig up EM Cable through A-Frame over A-Frame block.
- Hookup weight 4,000 lbs to EM Cable.
- Set HC at midposition (refer to Section 10).
- Lift weight approximately 5 ft and hold 5 minute.
- Calibrate load sensors and cable payout counter.
- Repeat above with 7,000 and 10,000 lb weights.
- Hookup 15,000 weight amd lift slightly and set tension relief setting.

.2 Responsibility - GMDI

- EM Winch Operator
- Rig Crew
- Shipyard Crane Operator

.3 Operational Restrictions

.4 Precautions/Hazards

- Maintain EM Cable loading to below 12,000 lbs except during final relief setting.

.5 Special Equipment

- 4,000, 7,000, 10,000 (approx.) and 25,000 lb weights.
- Weight terminal connection to EM Cable (Geotech).

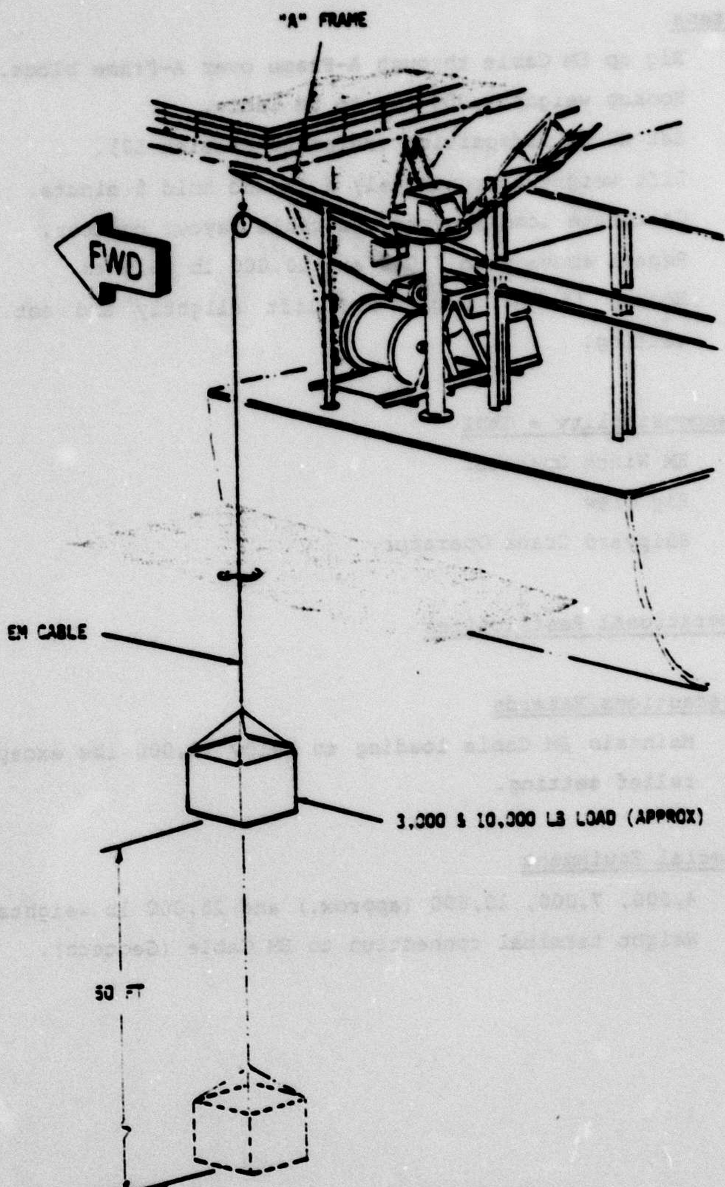

FIGURE 1-2. EM WINCH PRE-CHECKOUT

1.2 EM WINCH PRE-CHECKOUT

.1 Steps

- Rig up EM Cable through A-Frame over A-Frame block.
- Hookup known weight to EM Cable termination.
- Set HC at midposition.
- Payout and take in at minimum and maximum speeds.
- Check calibration of load sensors and cable payout counter.

.2 Responsibility - GMDI

- EM Winch Operator
- Rig Crew
- Crane Operator

.3 Operational Restrictions

.4 Precautions/Hazards

- Maintain EM Cable loading to below 12,000 lbs.

.5 Special Equipment

- Known shipboard weight.
- Weight terminal connection to EM Cable (Geotech).

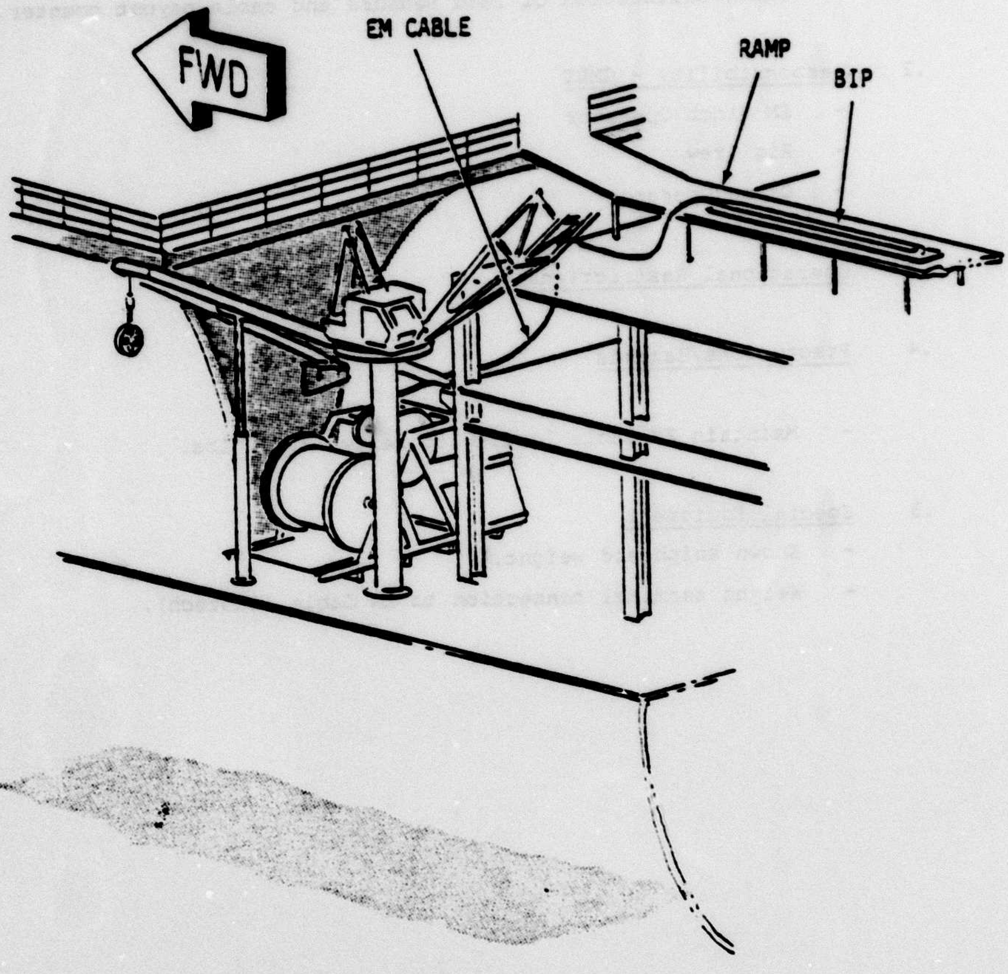

FIGURE 1-3. EM CABLE CIRCUITRY PRE-CHECK

1.3 EM CABLE CIRCUITRY PRE-CHECKOUT

.1 Steps

- Rig EM Cable through A-Frame and pull cable to reach BIP where stored.
- Connect EM Cable to BIP.
- Install interconnecting Cable between EM Winch slip rings and STC Van.
- Check all signals per Teledyne Geotech Test Plan.
- Connect DARS cable between STC Van and DARS checkout console.

.2 Responsibility - Geotech/Gould

- STC Van Operator
- Rig Crew
- EM Winch Operator
- DARS Operator

.3 Operational Restrictions

.4 Precautions/Hazards

.5 Special Equipment

- EM Interconnecting Cable
- EM Cable Winch
- STC Van
- BIP
- DARS Checkout Console
- DARS Cable

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1.4 REENTRY SUB RELEASE DEMONSTRATION

.1 Steps

- Install hydraulic plug adaptor and Baker tool in control sub.
- Install special hydraulic sub/handling fixture on reentry control sub.
- Set reentry sub (without stinger) vertically on main deck and support off adjacent structure.
- Connect up EM Cable to BIP and check circuitry.
- Raise BIP using crane and guide into reentry sub.
- Set release pins.
- Set carpenter's clamp on EM Cable to restrict vertical fall.
- Pressurize SW hydraulics to 2200 psi and actuate release.
- Pressurize SW hydraulics to 2800 psi and actuate gate release.
- Lower reentry sub, disassemble, and remove BIP.

.2 Responsibility - GMDI

- Rig Crew
- Van Operator

.3 Operational Restrictions

.4 Precautions/Hazards

- Pressurized system of 2800 psi
- Safe handling of BIP

.5 Special Equipment

- Hydraulic Sub/Handling Fixture
- Koomey Pump

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2.0 SCIENTIFIC TESTING

2.1 PROCEDURES

- No specific MSS procedure involved.

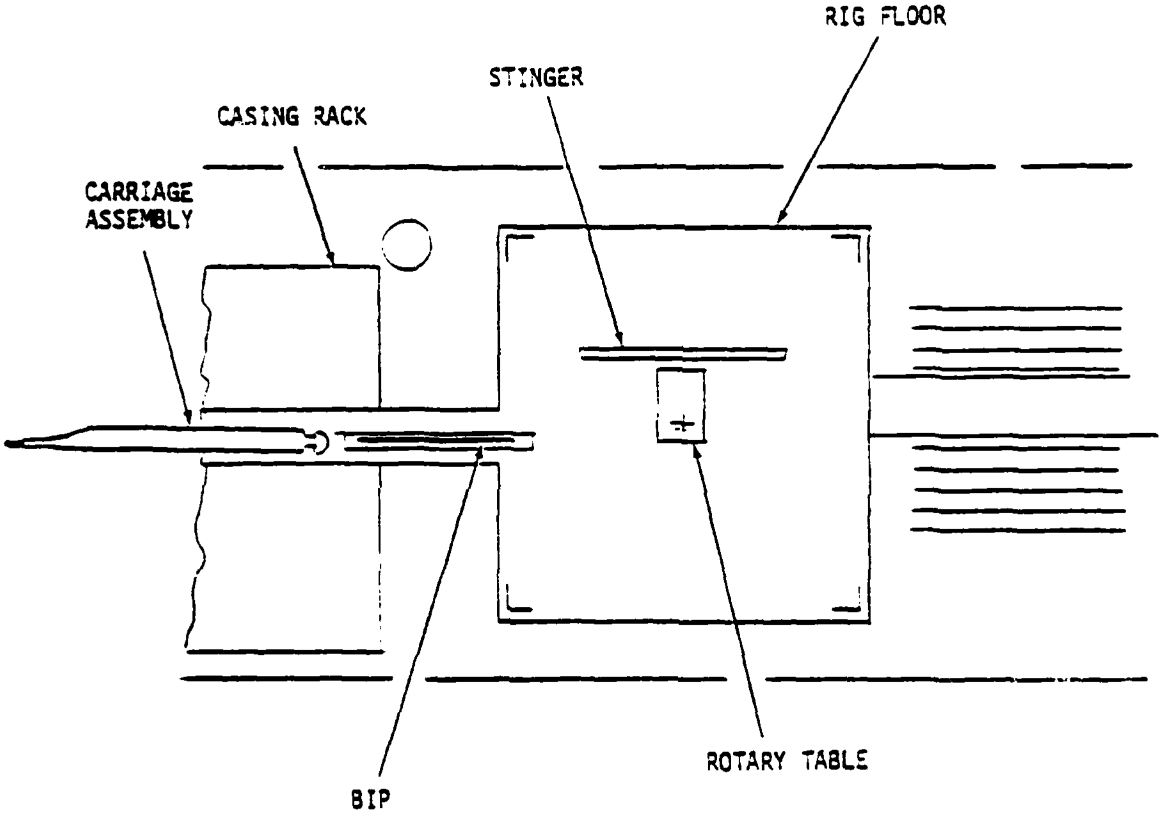

FIGURE 3-1 PREPARING RIG FLOOR

3.0 DEPLOYMENT PROCEDURE

3.1 PREPARING RIG FLOOR

.1 Steps

- Move reentry tool stinger, BIP carriage housing, control sub and hydraulic plug to rig floor.
- Move BIP with cradle to ramp area.
- Assemble hydraulic plug in control sub.
- Assemble control sub and carriage housing with drill collar handling sub.
- Tack weld bolts.

.2 Responsibility - GMDI

- Crane Operator
- Rig Crew

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazard

- Avoid slamming items into structure.

.5 Special Equipment

- Slings
- Reentry Subassembly
- BIP
- Tag Lines
- Drill Collar Handling Sub

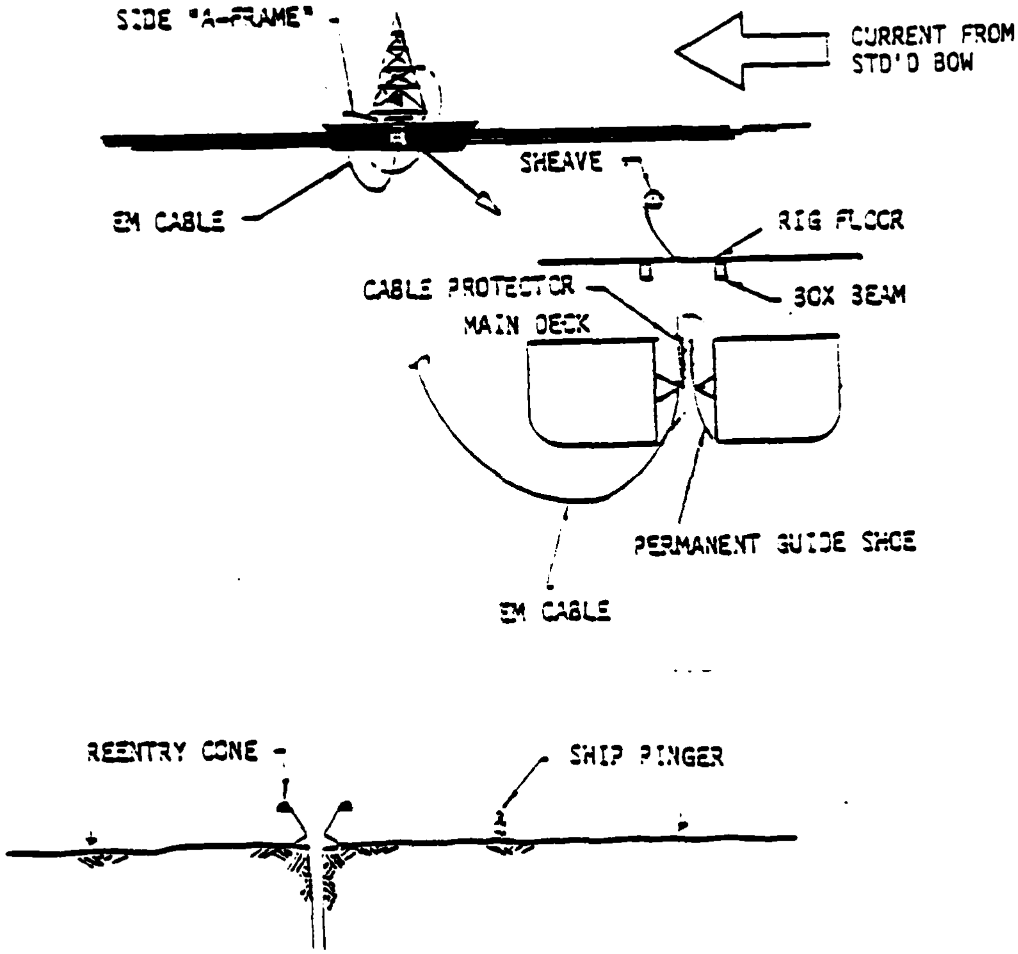

FIGURE 3-2 KEELHAUL EM CABLE

3.2 KEELHAUL EM CABLE

.1 <u>Steps</u>

- Attach keelhaul line to EM Cable watertight connector.
- Payout EM Cable 200 ft.
- Pull EM Cable through horn.
- Place cable protector within horn.
- Lead EM Cable through derrick mounted sheave.

.2 <u>Responsibility</u>

- EM Winch Operator
- Rig Crew

.3 <u>Operational Restrictions</u>

- Sea State 4

.4 <u>Precautions/Hazards</u>

- Keep terminal connector dry.
- Keep cable in protector.
- Keep enough tension to maintain cable away from thrusters and propellers.
- Try to minimize cable rubbing on bilge keel and guide hornlip.

.5. <u>Special Equipment</u>

- Keelhaul Line
- EM Cable Winch
- A-Frame
- Derrick Sheave
- Cable Protector, GMDI E-001-A013, E-001-A014
- Cable Pull Assembly, Geotech 990-53574-0101

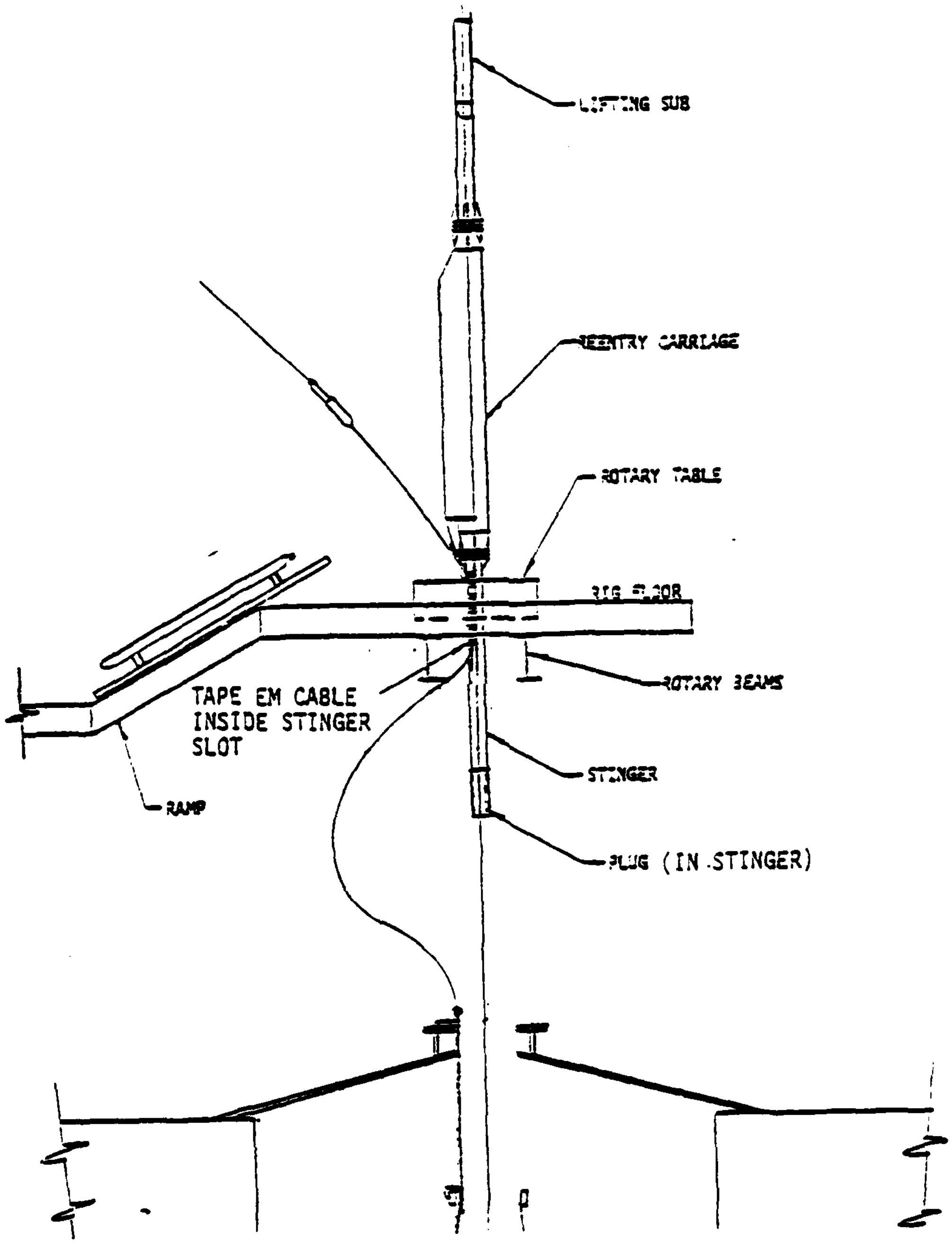

FIGURE 3-3 SET REENTRY SUB ON RIG FLOOR

3.3 SET REENTRY SUB ON RIG FLOOR

.1 Steps

- Install stinger in slips on rotary table.
- Insure EM Cable is protected in stinger slot, use tape to secure.
- Install handling sub on carriage control sub.
- Move carriage to rig floor and vertical erect on stinger and bolt up.
- Tack weld bolts.

.2 Responsibility - GMDC/GMDI

- Crane Operator
- Rig Crew

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazards

- Avoid slamming reentry sub into steel structure.

.5 Special Equipment

- Reentry Sub Handling Sling, GMDI D-001-A031
- Carriage Control Sub, GMDI E-001-A008
- SW Hydraulic Test Pump
- Tag Lines
- Drill Collar Handling Sub
- 12" Casing Slips
- Stinger/Slips Adaptor, GMDI D-001-A033

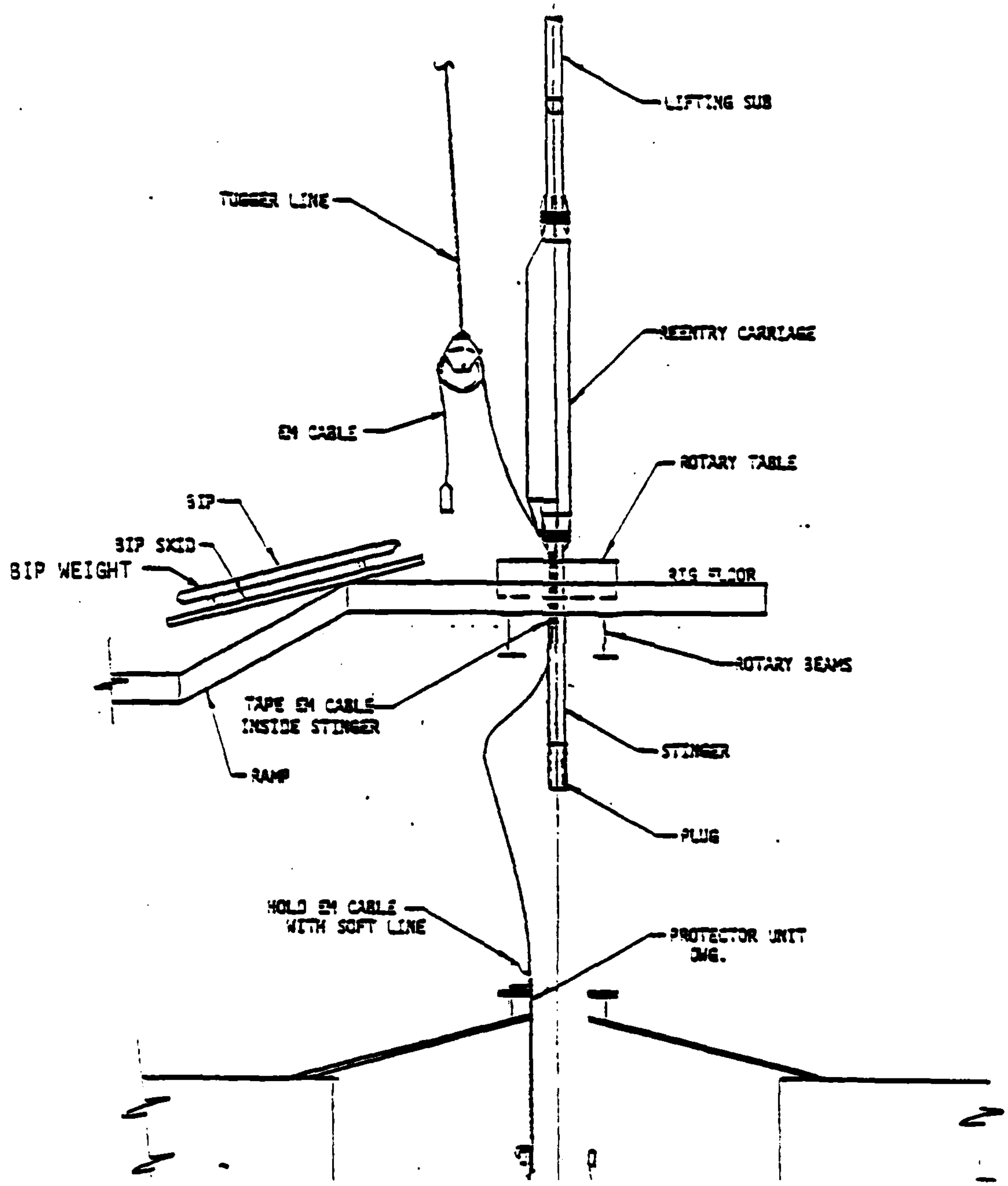

FIGURE 3-4 MOVE BIP TO RIG FLOOR

3.4 MOVE BIP TO RIG FLOOR

.1 Steps

- BIP is in shipping fixture and on pipe ramp.
- Remove covers and install lifting lug.
- Make up mechanical EM Cable attachment.
- Install EM Cable grip near sheave.
- Attach BIP ballast weight.

.2 Responsibility - GMDC/Geotech

- EM Winch Operator
- Crane Operator
- Rig Crew

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazards

- Prevent BIP from slamming into steel structure.

.5 Special Equipment

- BIP Shipping Fixture
- BIP Weight
- EM Cable Grip
- Lifting Sub
- BIP Handling T-bar, GMDI D-001-A032

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3.5 ATTACH EM CABLE TO BIP

.1 Steps

- Make up electrical EM Cable connection.
- Apply sealant.
- Test BIP through STC Van.
- Attach BIP handling strap.

.2 Responsibility - Geotech

- Rig Crew
- STC Van Operator

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazards

- No hard handling of BIP.

.5 Special Equipment

- Sealant (Geotech)
- BIP Handling Strap

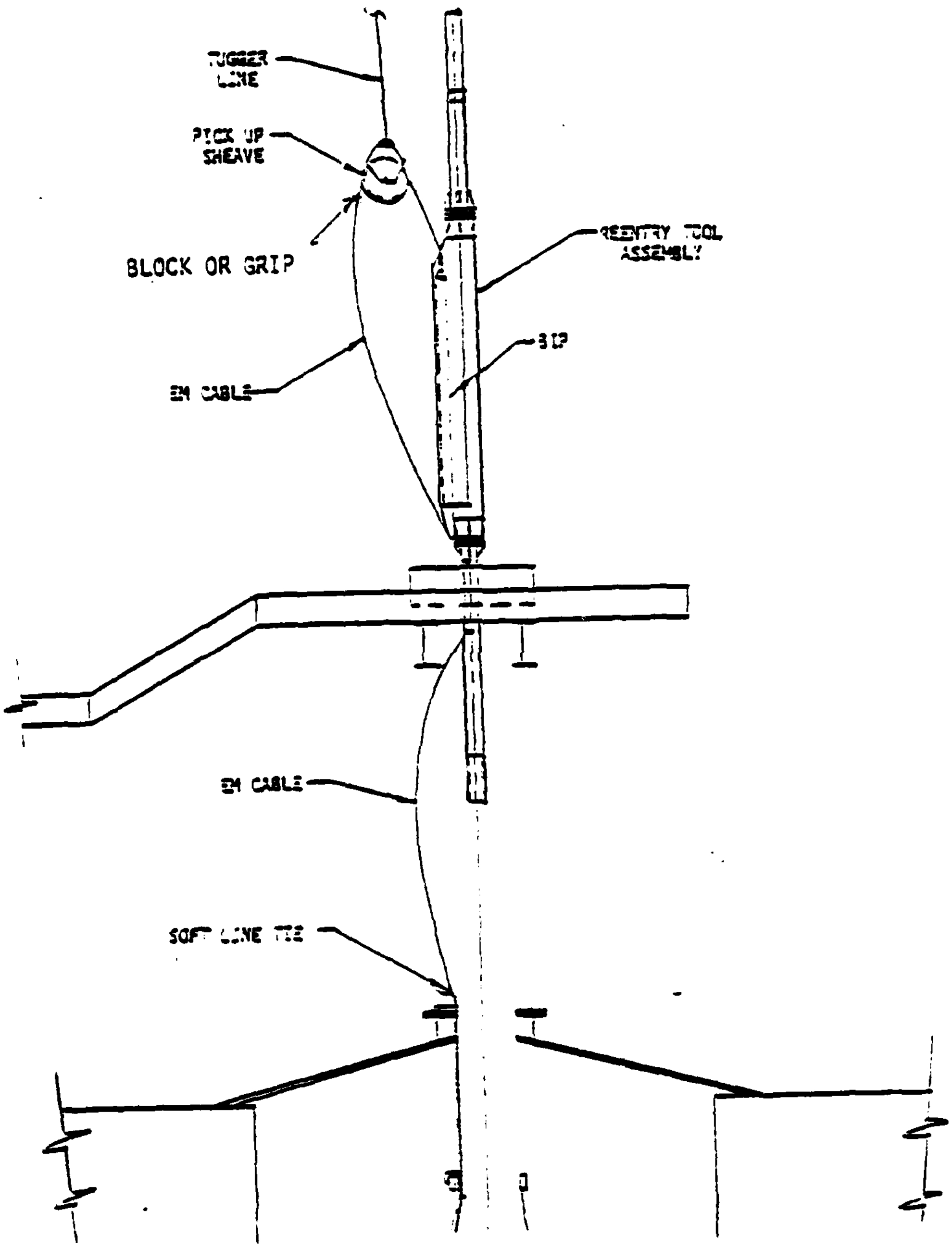

FIGURE 3-6 ERECT AND INSTALL BIP

3.6 ERECT & INSTALL BIP

.1 Steps

- Remove steel transit pins from shear pin holes.
- Lower top or carriage housing to level of rig floor.
- Lift BIP from horizontal position & erect vertically using crane and tuggers.
- Transfer BIP load to EM Cable support sheave.
- Using tugger, raise BIP and guide into reentry sub (refer to sequence diagram).
- Position reentry sub carriage slide and install release pins.
- Tighten reentry sub release cable tension.
- Test BIP through STC Van.

.2 Responsibility - GMDC/GEOTECH/GMDI

- Crane Operator
- Rig Crew
- STC Van Operator

.3 Operational Restrictions

- Sea State 4

.4 Precaution/Hazards

- Prevent BIP from slamming into steel structure.
- Do not damage EM Cable with high side loads.

.5 Special Equipment

- Shear Pins, Aluminum with Milled Flats
- Carriage Cable Adjustment Tool
- BIP Alignment Jack

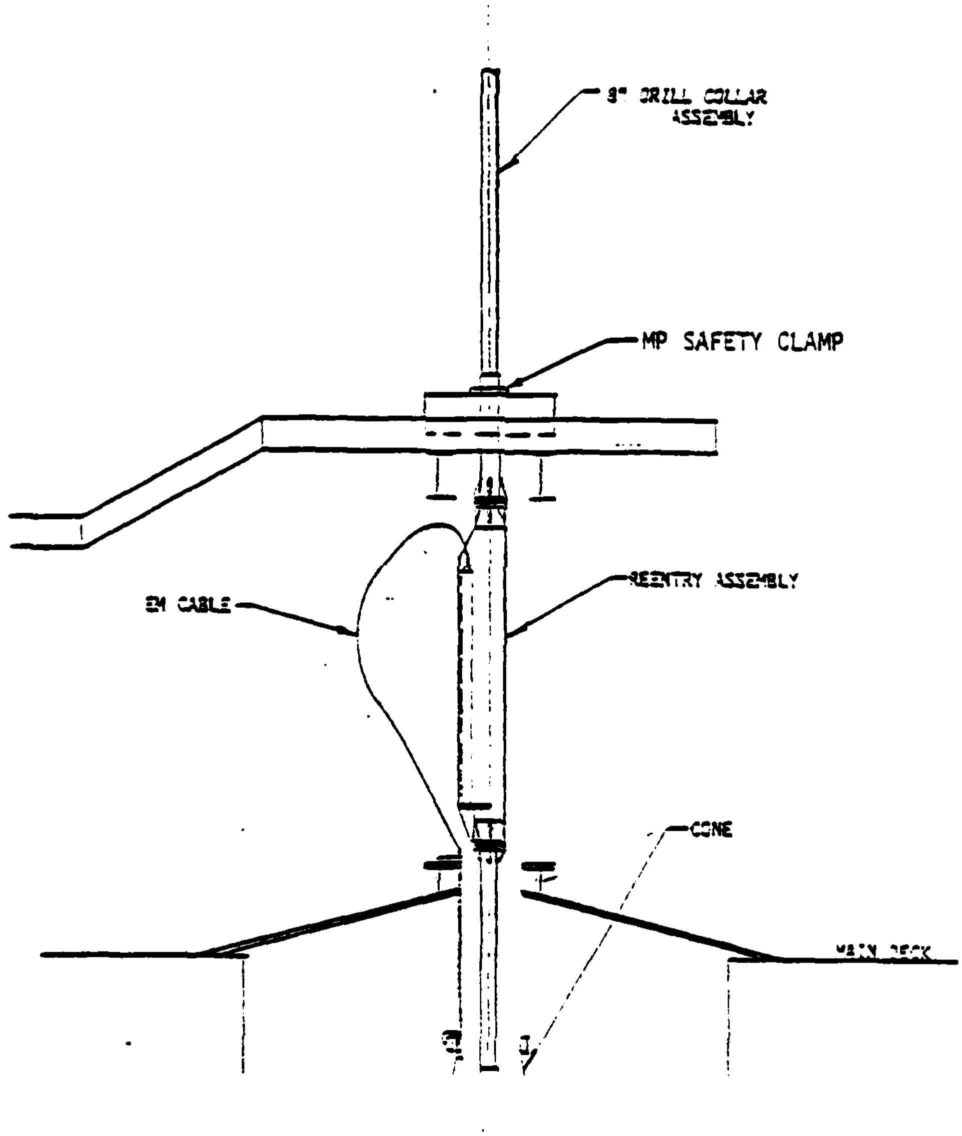

FIGURE 3-7 MAKE-UP LOWER REENTRY ASSEMBLY

3.7 MAKE UP LOWER REENTRY ASSEMBLY

.1 Steps

- Lower Carriage Control Sub top to rig floor level.
- Remove EM Cable from sheave.
- Work EM Cable down through rotary table.
- Set slips and safety clamp.
- Make up lower downhole assembly to reentry sub.
- Lower reentry sub to main deck area.
- Install upper section of hydraulic tubing.
- Orient drill string.
- Final check hydraulic tubing, diaphragm, release cylinders and release gate.

.2 Responsibility - GMDC

- Normal Rig Crew
- EM Cable Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 3

.4 Precautions/Hazards

.5 Special Equipment

- 12" Casing Slips (for Control Sub)
- Safety Clamp
- Lowering Line

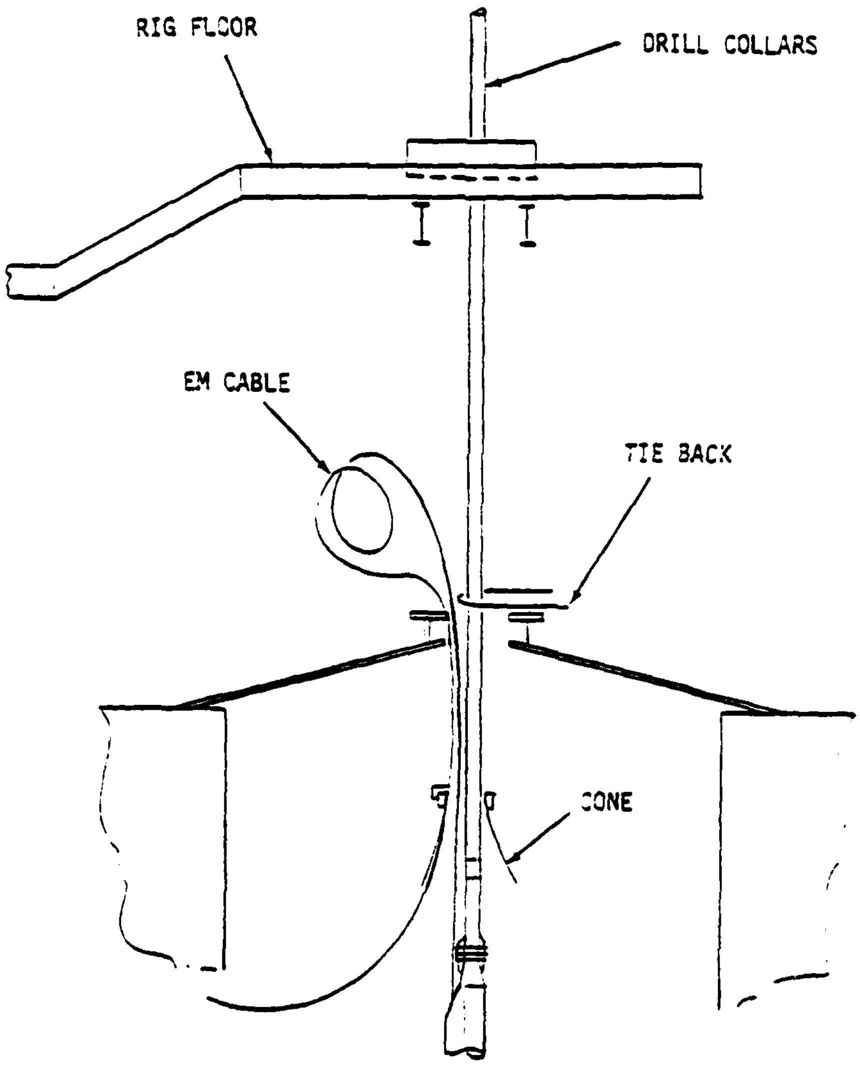

FIGURE 3-8 MAKE-UP UPPER REENTRY ASSEMBLY

3.8 MAKE UP UPPER REENTRY ASSEMBLY

.1 Steps

- Add Drill Collar and 5 Bumper Subs (see Ref. Dwg E-001-A002).
- Lower reentry sub below horn.
- Secure drill collar to one side of horn.
- Remove EM Cable protector.
- Lower downhole assembly approx. 300 ft.
- Work EM Cable loop down through horn using soft line.
- Establish _____ lbs tension loading on EM Cable winch (refer to separate EM Cable/HC Instructions).
- Check BIP signals.
- Set orientation for reentry sub.

.2 Responsibility - GMDC

- Rig Crew
- EM Cable Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 3

.4 Precautions/Hazards

- Keep cable away from thruster and screws.
- Limit side loading on EM Cable termination.

.5 Special Equipment

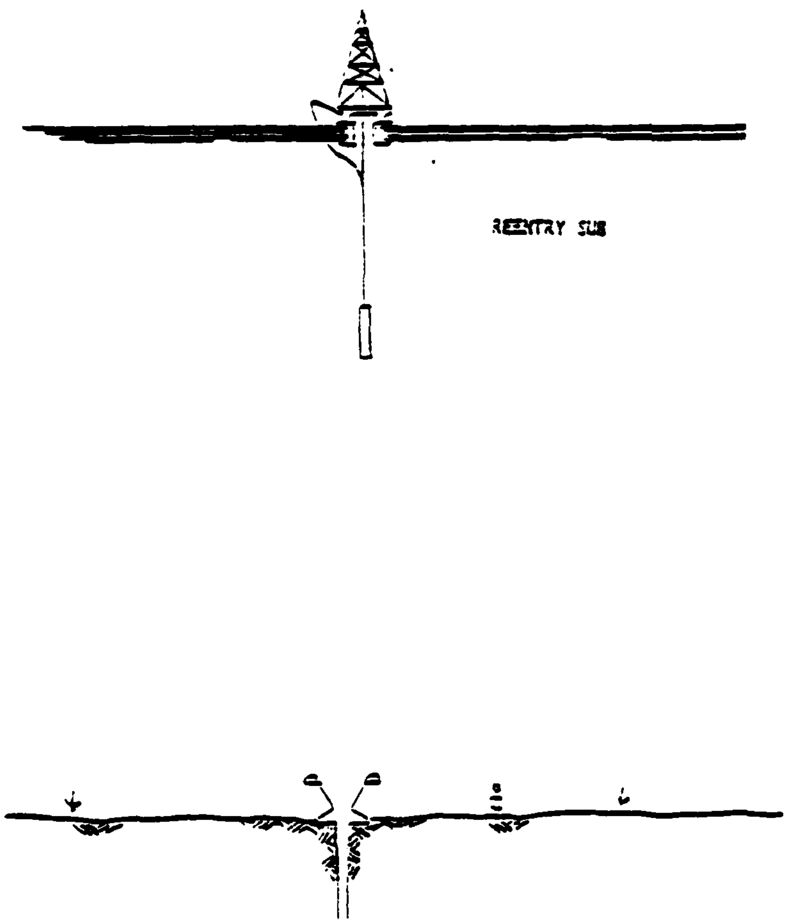

FIGURE 3-9   DEPLOY DRILL STRING

3.9 DEPLOY DRILL STRING TO NEAR BOTTOM

.1 Steps

- Set A-Frame HC at midposition.
- Make up and lower standard drill pipe sections.
- Orient pipe string at each stand using scribe marks.
- Deploy approximately 18,400 ft of 5 inch drill pipe, including 5 Bumper Subs, 1 Drill Collar and Carriage Assembly.
- Using normal procedures, and maintaining drill string orientation.
- Install upper horn sections (if required).
- Maintain cable tension at the BIP equivalent to 1,000 lbs (see EM Winch/HC instructions).

.2 Responsibility - GMDI

- Normal Rig Crew
- EM Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 5

.4 Precautions/Hazards

- Maintain orientation of drill string with scribe marks.
- Do not allow cable tension to exceed 3,000 lbs at BIP.

.5 Special Equipment

- None required.

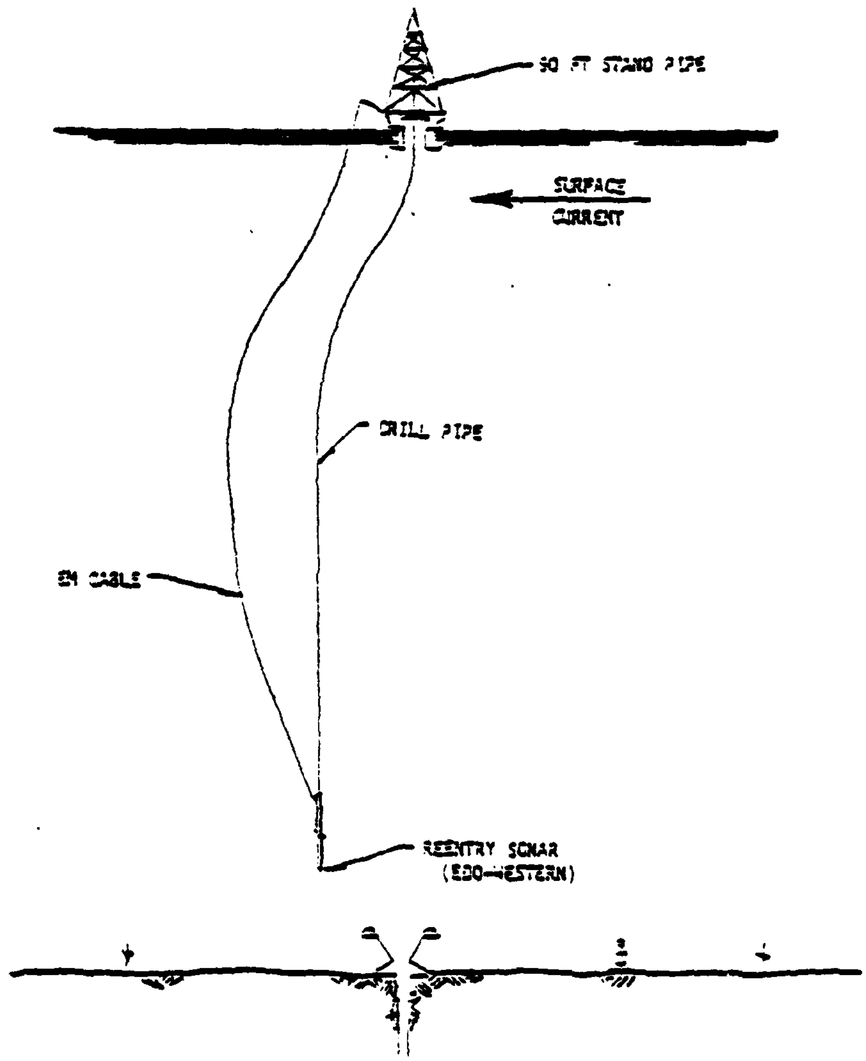

FIGURE 3-10 POSITION DRILL STRING ABOVE REENTRY CONE

3.10 POSITION DRILL STRING ABOVE REENTRY CONE

.1 <u>Steps</u>

- Run reentry tool
- Establish stinger altitude above cone at objective 15 ft above cone.
- Add drill string heave compensator (tentative).
- Prepare upper drill string for sonar reentry.
- Lower sonar reentry tool down to stinger position over reentry cone in accordance with standard procedures.
- Prepare to stab 60 ft.
- Maintain cable tension at BIP equivalent to 1,000 lbs.

.2 <u>Responsibility - GMDC</u>

- Normal Rig Crew
- EM Cable Winch Operator
- STC Van Operator

.3 <u>Operational Restrictions</u>

- Sea State 5

.4 <u>Precautions/Hazards</u>

.5 <u>Special Equipment</u>

- Sonar Reentry Tool

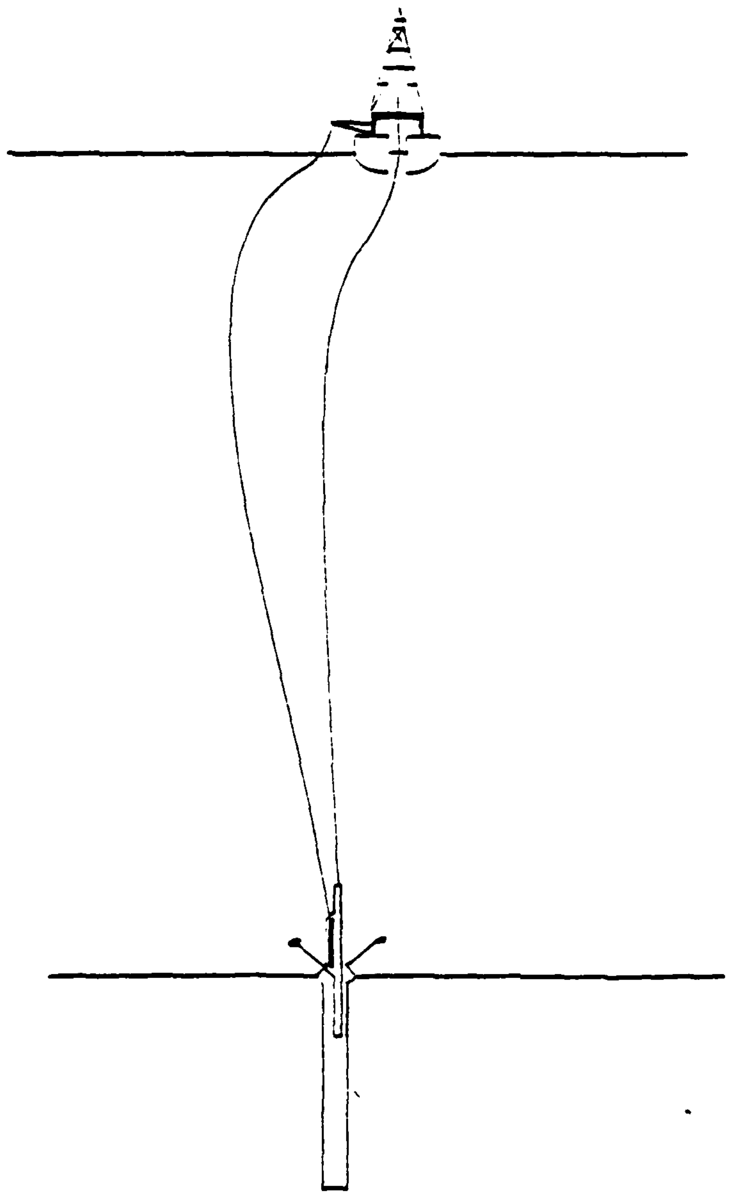

FIGURE 4-1 REENTRY ACCOMPLISHED & CARRIAGE LANDED IN CONE

4.0 REENTRY PROCEDURE

4.1 PERFORM REENTRY STABBING

.1 Steps

- Payout approximately 30 ft of EM Cable.
- Reduce EM Cable tension applicable to 500 lbs at BIP.
- Lower DP 60 ft and stab into reentry cone (quickly accelerate to 6 ft per second and then slowly decelerate).
- During reentry, observe payout of the EM Cable.
- Record impact forces.
- Maintain hook load approximately 30,000 lbs lighter after reentry than before reentry.
- Increase EM Cable tension to 1,500 lbs at the BIP.

.2 Responsibility - GMDC

- Rig Crew
- EM Winch Operator
- STC Van Operator
- Reentry Technician

.3 Operational Restrictions

- Sea State 3
- Max stabbing velocity of 10 ft per second.
- Max unloading of the drill string 50,000 lbs.

.4 Precautions/Hazards

- Maintain minimum tension on the EM Cable as defined by operating instructions.
- Initial altitude above the seafloor should be 40 ft.
- Minimum hook load as directed, to be maintained.

.5 Special Equipment

- None required.

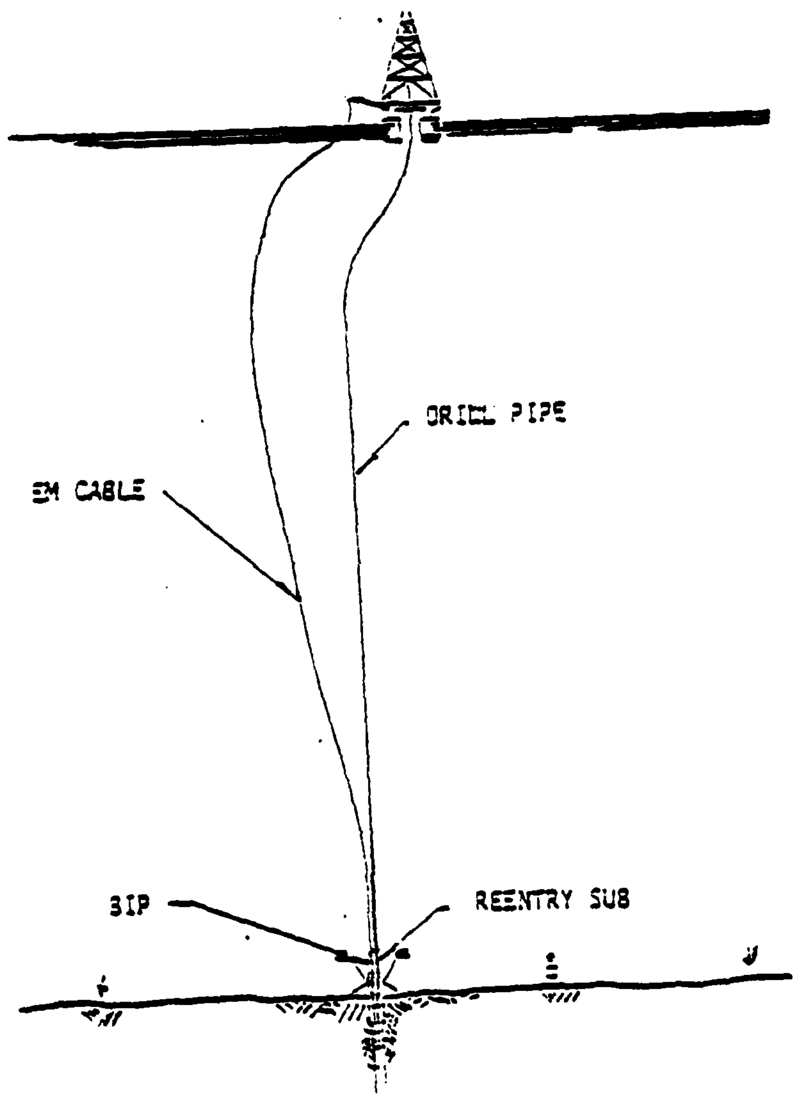

FIGURE 5-1 RELEASE BIP

5.0 BIP RELEASE PROCEDURE

.1 Steps

- Pull out the Edo Tool.
- Make up the Baker R.B. -2 Equalizing Valve on sinker bars.
- Install the Otis Wire Line Stuffing Box in the drill pipe.
- Run the Baker Valve through drill pipe and seat on No-Go in control sub/plug.
- Tighten the Packing Assembly on Otis Stuffing Box.
- Hook up high pressure line from cement pump to Otis Tool.
- Set EM Cable tension to the required tension.
- Pressure up on the drill pipe to 2,300 psi to activate the hydraulic cylinders and shear pins.

.2 Responsibility - GMDC

- EM Winch Operator
- STC Van Operator
- Rig Crews

.3 Operational Restrictions

- Sea State 3

.4 Precautions/Hazards

.5 Special Equipment

- Baker R.B. - 2 Equalizing Valve
- Otis Wire Line Stuffing Box with Tee Crossover to D.P.

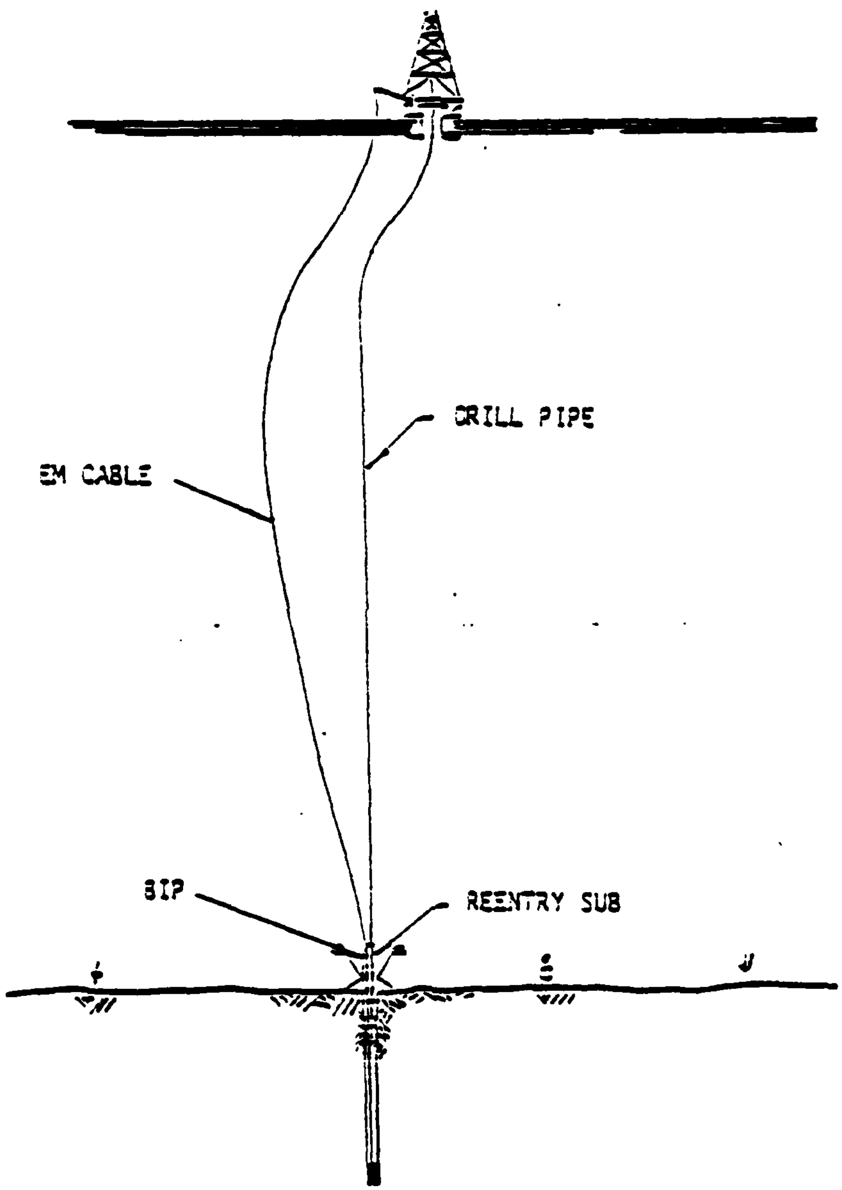

FIGURE 5-2 LOWER BIP INTO BOREHOLE

5.2 LOWER BIP INTO BOREHOLE

.1 Steps

- EM Cable should slowly payout.
- Reduce tension to minimum 500 lbs at BIP in 250 lb stages.
- When cable starts to payout, set tension to neutralize payout.
- Reduce tension by 500 lb and lower BIP to borehole bottom (1,000 ft) and record time and cable footage.
- At bottom increase cable tension to approximately 2,000 lbs at BIP.
- Observe seismic and accelerometer readings

.2 Responsibility - GMDC

- EM Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 5

.4 Precautions/Hazards

- Cable entanglement
- BIP binding in stinger

.5 Special Equipment

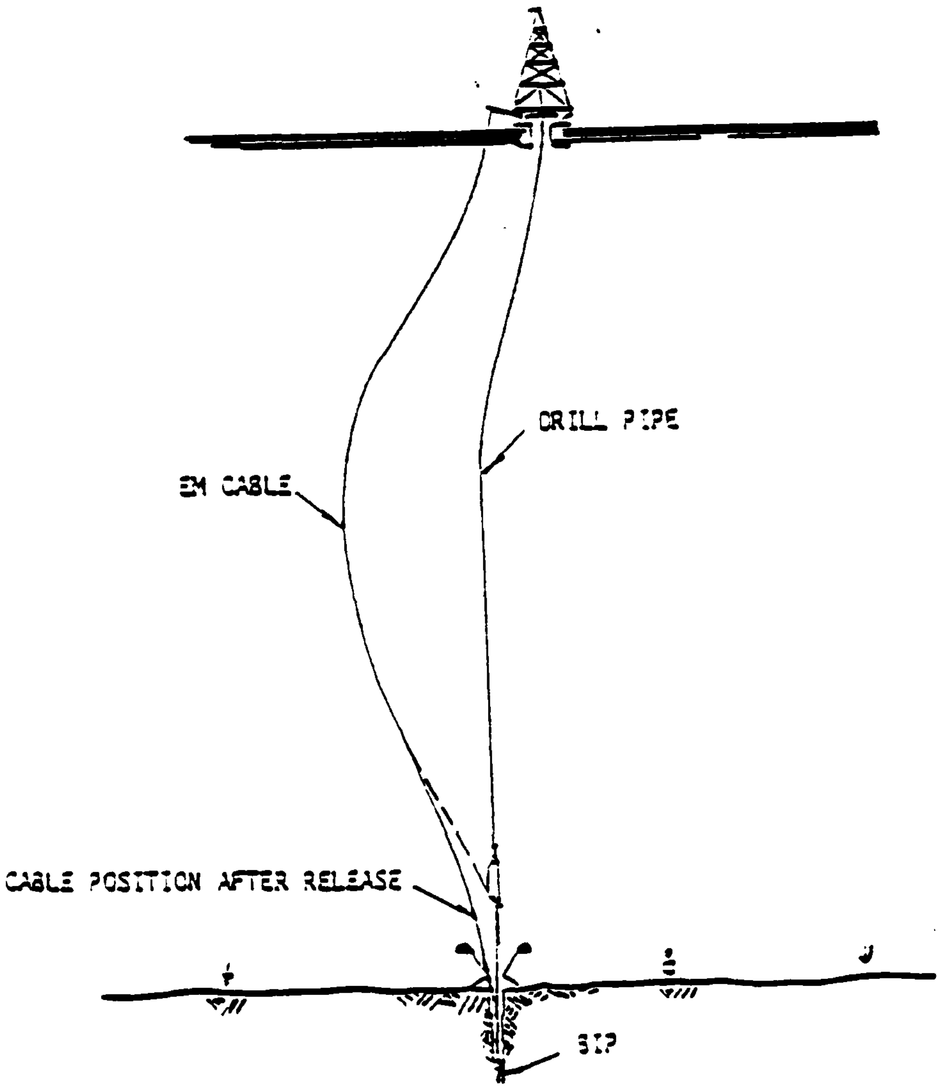

FIGURE 5-3 DISENGAGE EM CABLE

5.3 DISENGAGE EM CABLE

.1 Steps

- Set EM Cable winch tension to 500 lbs at BIP.
- Observe any change in EM Cable tension or payout/takein during operation.
- Establish ship position 200 ft upstream to current.
- Rotate ship/drill string to orient reentry sub groove downstream (if necessary).
- Raise drill string quickly 90 ft.
- Raise hydraulic pressure to 3,000 psi to release hydraulic gate.
- Rotate pipe string 180° in both directions. (If entanglement indicated).
- Position vessel 500 ft upstream of borehole.
- Repeat above rotation 360° in both directions, if tension increases or payout was indicated.
- Watch fleet angle of EM Cable.

.2 Responsibility - GMDC

- Rig Crew
- Ship's Crew
- EM Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazards

- Limit EM Cable tension load to 15,000 lbs.
- Maintain EM Cable away from thrusters and screws.

.5 Special Equipment

- EM Cable Winch.

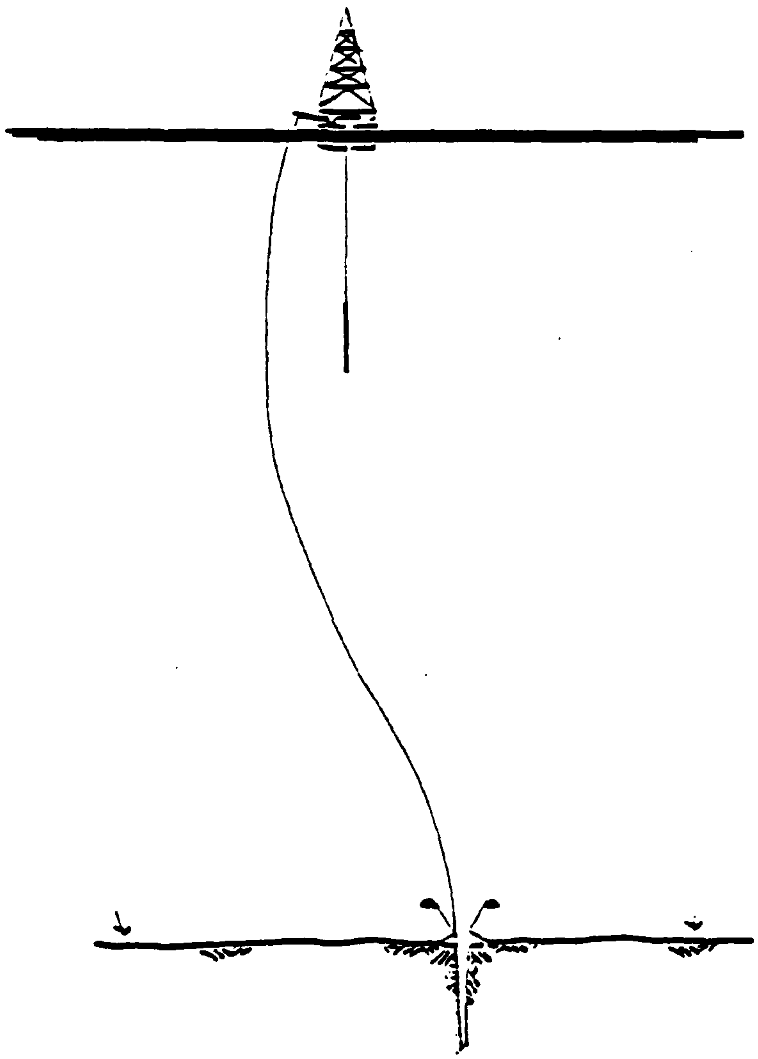

FIGURE 5-4 RECOVER DRILL STRING AND REENTRY SUB

5.4 RECOVER DRILL STRING & REENTRY SUB

.1 <u>Steps</u>

- Maintain <u>Challenger</u> 500 ft upstream of borehole.
- Maintain EM Cable winch tension applicable to water depth.
- Recover pipe string under normal procedures.
- Raise reentry sub to drill rig floor.
- Attach handling sling to reentry sub.
- Remove stinger and move to casing rack.
- Move reentry sub to casing rack.

.2 <u>Responsibility - GMDC</u>

- Rig Crew
- Ship's Crew
- EM Winch Operator
- STC Van Operator

.3 <u>Operational Restrictions</u>

- Sea State 4

.4 <u>Precautions/Hazards</u>

- Limit EM Cable load to water depth weight of cable.

.5 <u>Special Equipment</u>

- Reentry Sub Handling Equipment

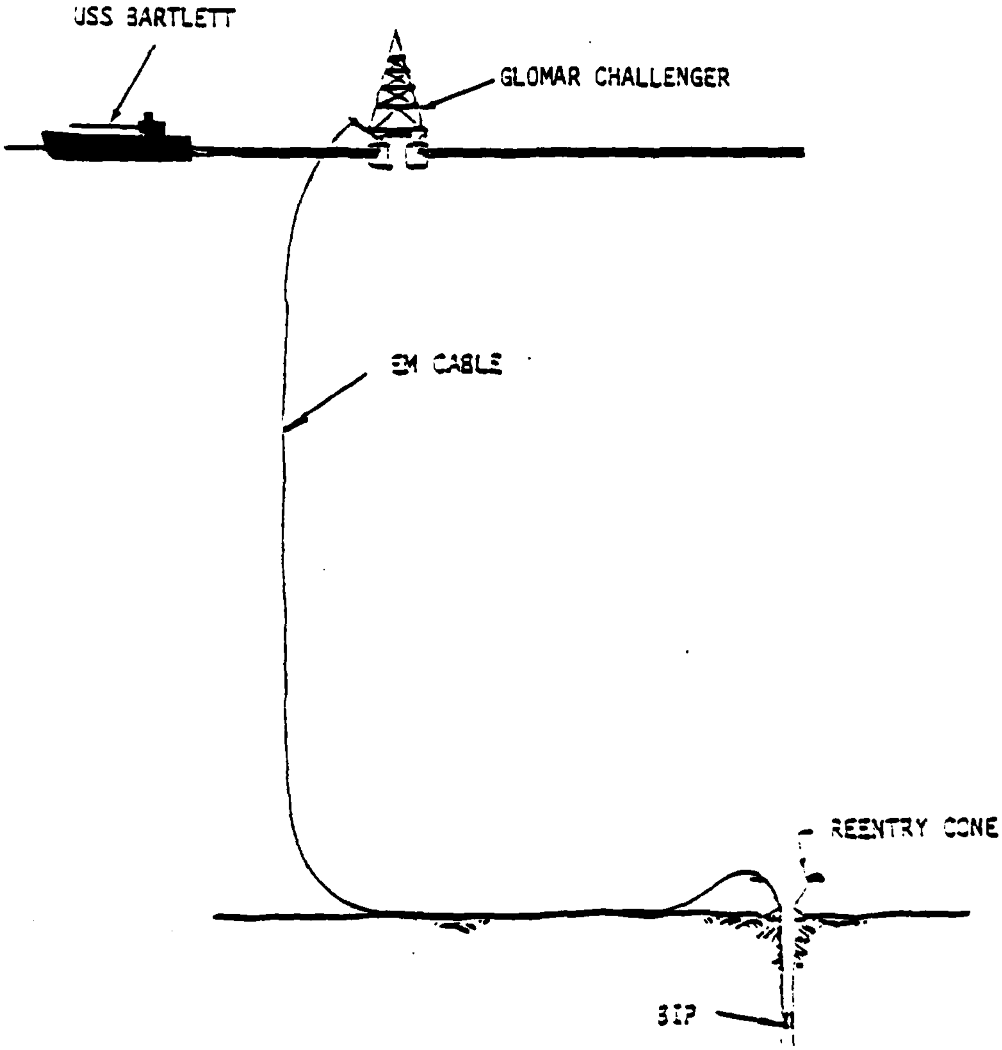

FIGURE 6-1 VESSEL MOVING TO TEST STATION

6.0 SEISMIC TEST PROCEDURES

6.1 VESSEL MOVING & PAYING OUT ALL EM CABLE

.1 Steps

- Move *Challenger* downstream from the borehole maintaining general orientation into the weather while paying out all EM cable except the last 150 ft.
- Maintain EM Cable tension applicable to 0 lbs at the ocean floor (refer to EM Cable/HC detail instructions).

.2 Responsibility - GMDC

- Ship's Crew
- EM Winch Operator
- STC Van Operator

.3 Operational Restrictions

- Sea State 6

.4 Precautions/Hazards

- Maintain cable away from thrusters and screws.

.5 Special Equipment

- Drop a new ASK Beacon (if necessary)

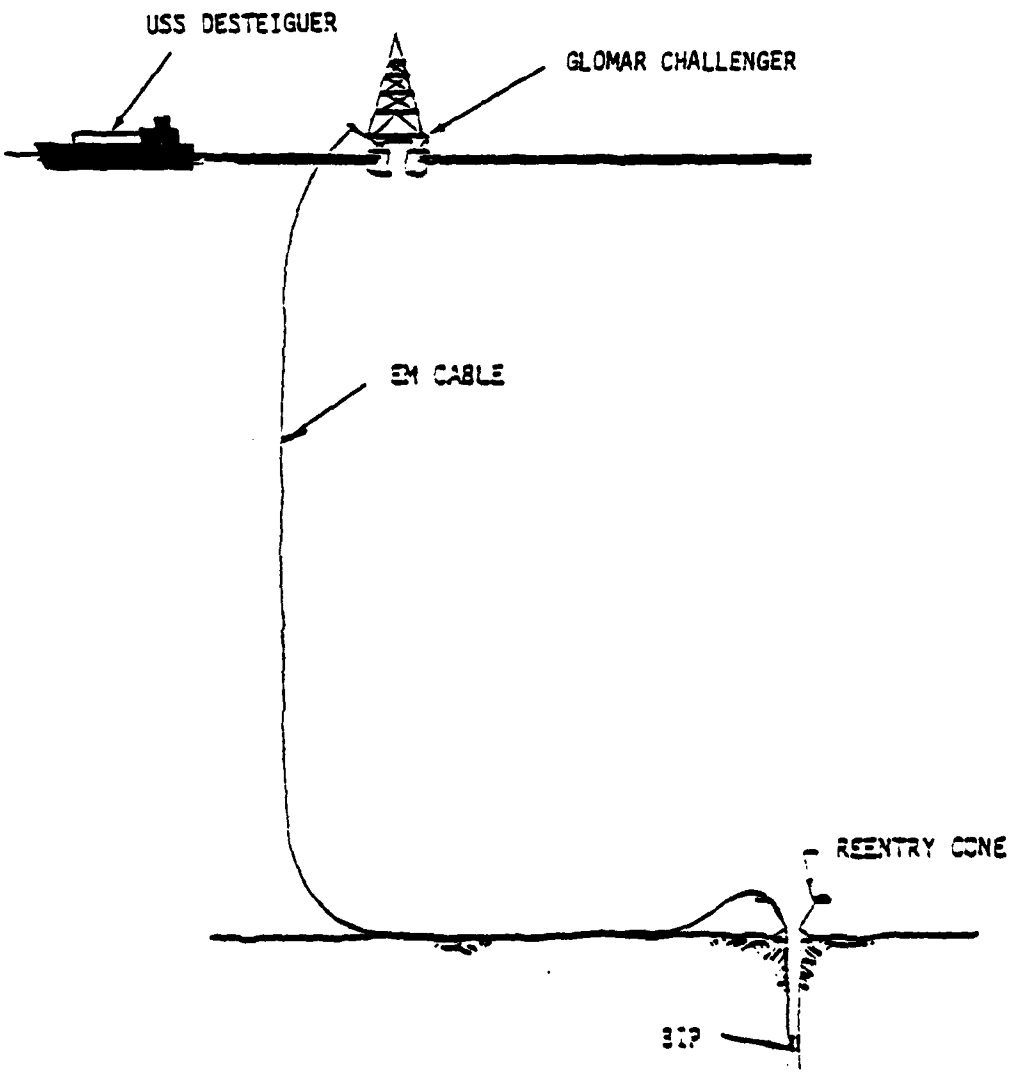

FIGURE 6-2 PERFORM SEISMIC TESTS

6.2 PERFORM SEISMIC TESTS*

.1 Steps

- Maintain ship position downstream of borehole with almost all cable payed out. (~500 feet minimum on winch)
- Record background noise for 4 hours.
- Perform air gun tests using AGOR.
- Perform slant range detonation tests using AGOR.
- Record background noise for up to 120 hours total.

.2 Responsibility - GMDC/NORDA

- Ship's Crew
- EM Winch Operator
- STC Van Operator
- Navy Vessel

.3 Operational Restrictions

- Sea State 6
- Maintain minimum 2,000 ft between ships.

.4 Precautions/Hazards

- Use of high explosive detonation.

.5 Special Equipment

- Navy AGOR Support Ship
- Explosives

*Specific Test sequence may change.

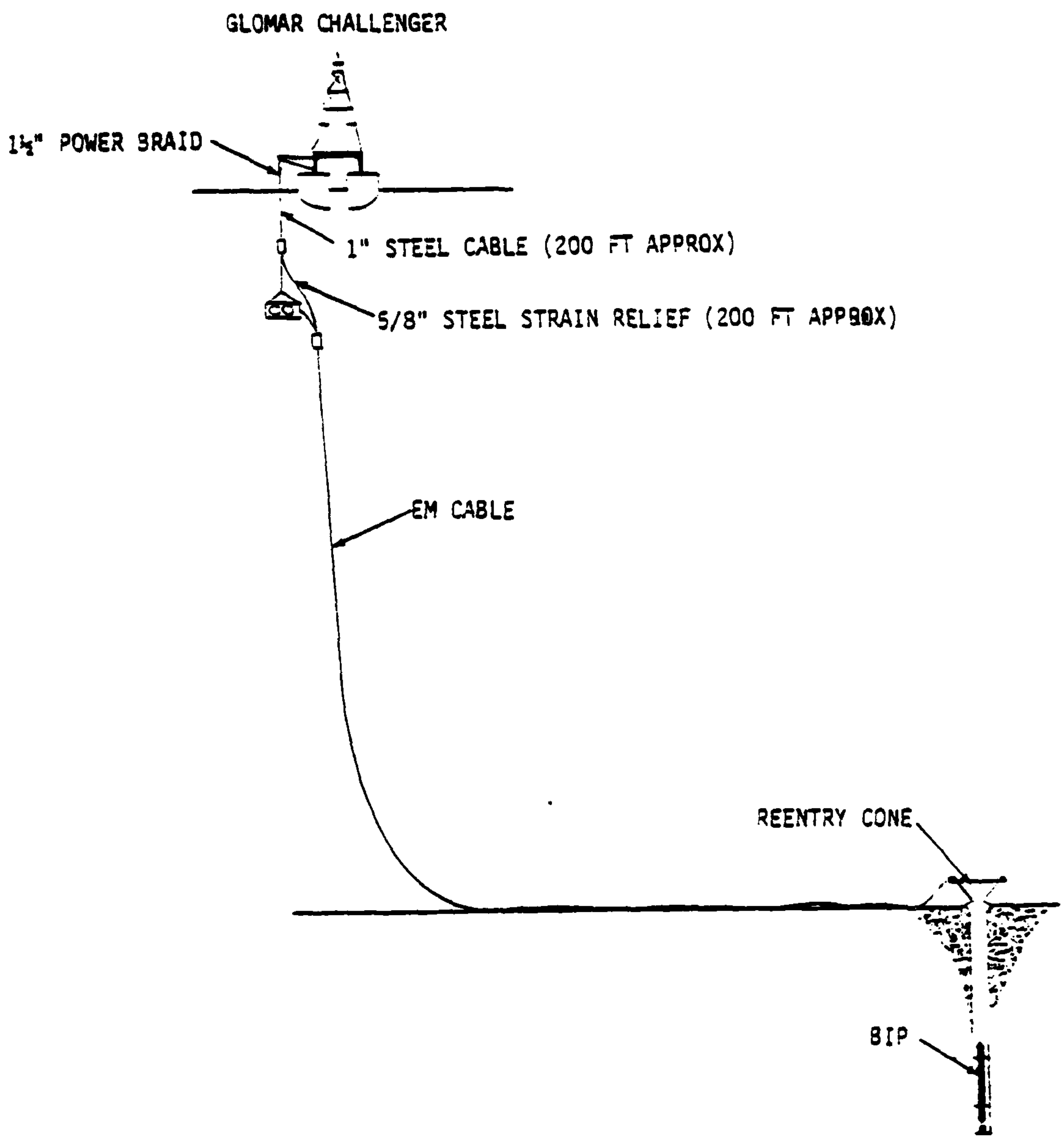

FIGURE 7-1 BPP LAUNCHED

7.0 IRR DEPLOYMENT

7.1 PAYOUT EM CABLE/LAUNCH BPP

.1 Steps

- Payout EM Cable to a minimum of 5 wraps on drum. (Clamped U-bolts end of Cable). Pull in A-Frame Sheave alongside ship.
- Put new clamps on EM Cable, pull up with crane. Re-attach clamps 120 ft from EM Cable end. Suspend the EM Cable by 2 cable clamps off side of Challenger.
- Rig for test and launch (refer to BPP launch instructions Section 11). Unreel EM Cable and attach to BPP.
- Perform DARS Operational check as required by the Gould Operators.
- Attach 1 in. steel cable, and 5/8 in. steel strain relief cable to the BPP package (Refer to the BPP launch instructions).
- Secure all cables to insure against chafing.
- Rig ships crane to launch BPP. Launch BPP package and transfer load to 1-1/2 in. mooring line on winch.
- Pay out 200 ft of steel cable, attaching the strain relief cable with tie wraps.
- Pull out A-Frame sheave to outboard position.

.2 Responsibility - GMDC

- Gould Representatives
- STC Van Operator
- Crane Operator
- Rig Crew
- Ship's Crew

.3 Operational Restrictions

- Sea State 4

.4 Precautions/Hazards

- Caution must be used to avoid overpulling EM Cable & BIP.
- BPP Package must be handled carefully to avoid damage.
- Caution must be used when handling the batteries.
- Caution must be used when feeding Power Braid rope from container to the EM Winch spool.

.5 Special Equipment

- Pelican Hook, Shackles, Steel Straps, Cable Clamps, Cullum Grips and Tie Wraps.

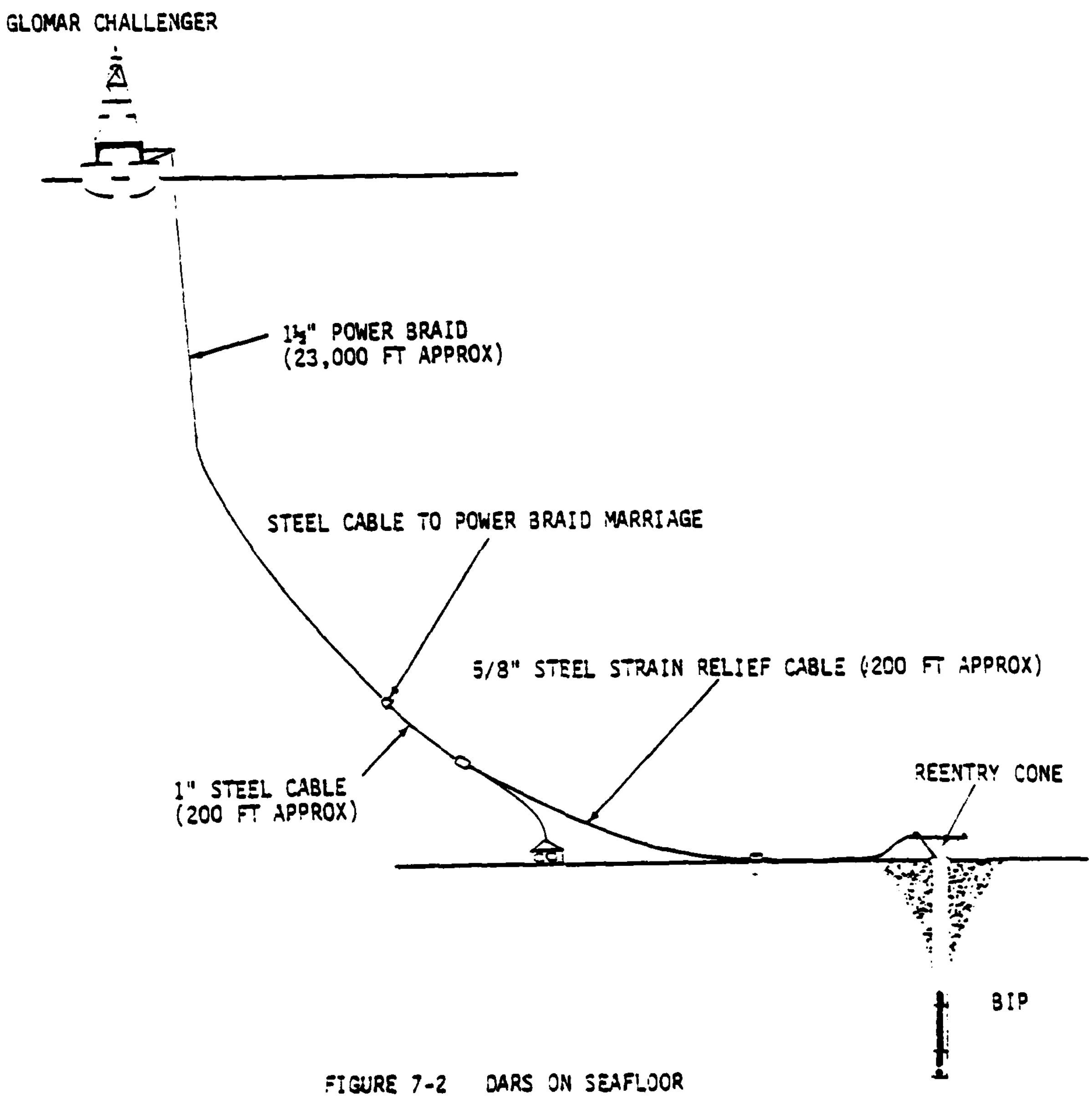

FIGURE 7-2 DARS ON SEAFLOOR

7.2 BPP DEPLOYMENT ON SEAFLOOR

.1 Steps

- Connect the 1-1/2 in. Power Braid to the bitter end of the 1 in. steel cable.
- Deploy the 1-1/2 in. Power Braid moving the ship downstream slowly on a direct line away from the reentry cone.
- Land the BPP package gently on the seafloor.
- Deploy the remaining 1-1/4 in. Power Braid.

.2 Responsibility - GMDC

- EM Winch Operator
- Rig Crew
- Ship's Crew
- Crane Operator

.3 Operational Restrictions

- Sea State 4/5.

.4 Precautions/Hazards

- Maintain the Power Braid clear of thrusters and screws.
- Use caution when feeding the line from container to reel.
- Take slack from the EM Cable before landing DARS on the seafloor.
- Avoid overpulling on the Power Braid and EM Cable.

.5 Special Equipment

- None required.

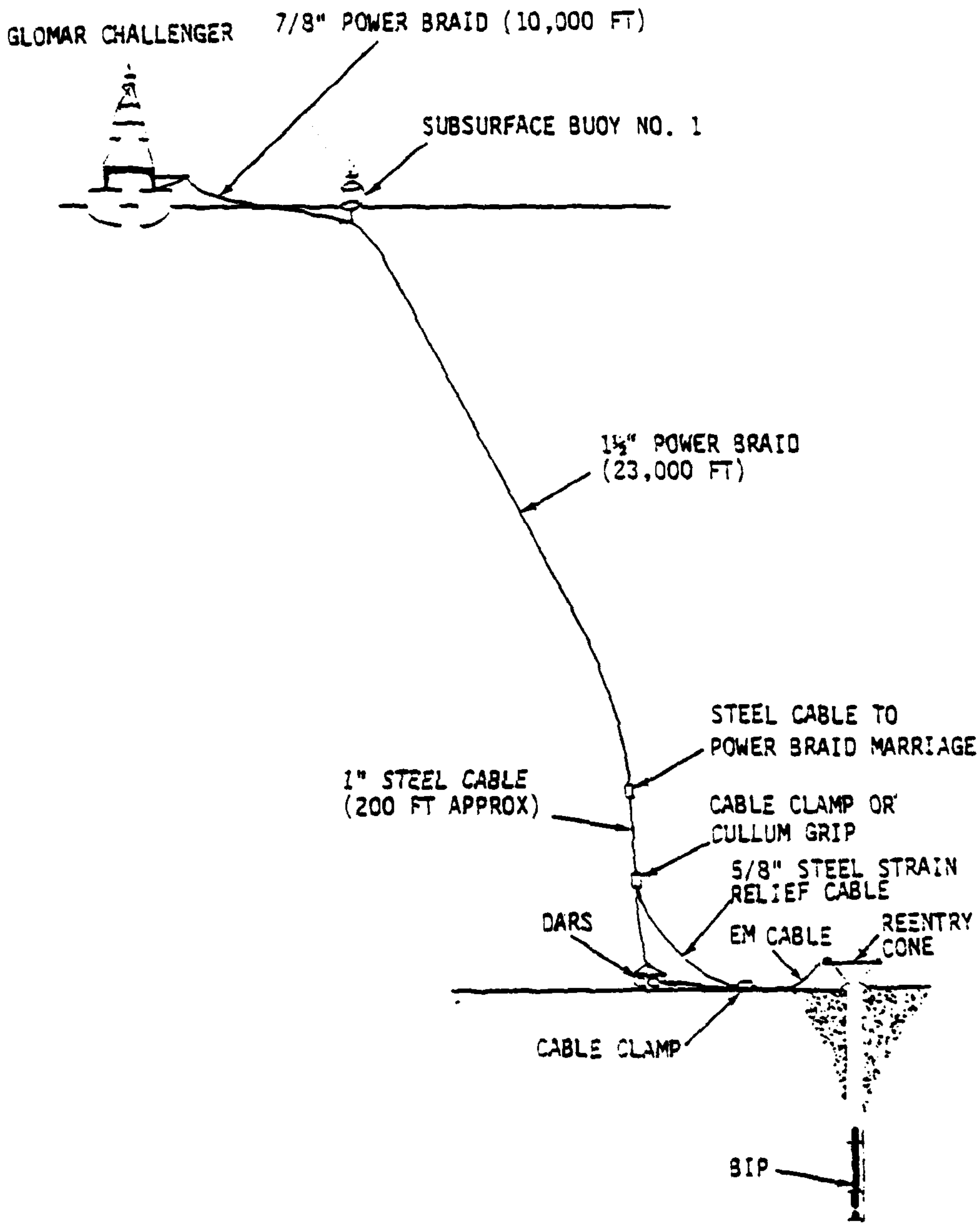

FIGURE 7-3 NO. 1 BUOY LAUNCHED

7.3 NO. 1 BUOY LAUNCH (IRR)

.1 <u>Steps</u>

- Stop the ship from drifting and hold position.
- Slack the tension on Power Braid Line.
- Rig a steel sling with a Pelican Hook to crane whip line.
- Attach Pelican Hook to the Buoy(s) #1, pick up and swing to the ship's side.
- Using a boat hook or other device pull the spliced eye at the 1-1/2 in. to 7/8 in. Power Braid to ship's side.
- Shackle the eye to the buoy and secure with seizing wire.
- Swing the buoy(s) over the side and into the sea.
- Move the ship downstream slowly.
- When the slack is out of the line, release Pelican Hook.
- Deploy the 10,000 ft of 7/8 in Power Braid while moving downstream.

.2 <u>Responsibility - GMDC</u>

- EM Winch Operator
- Rig Crew
- Ships Crew
- Crane Operator

.3 <u>Operational Restrictions</u>

- Sea State 4/5

.4 <u>Precautions/Hazards</u>

- Maintain the Power Braid clear of thrusters and screws.
- Use caution when feeding line from container to reel.
- Avoid overpulling on the Power Braid and EM Cable.

.5 <u>Special Equipment</u>

- None required.

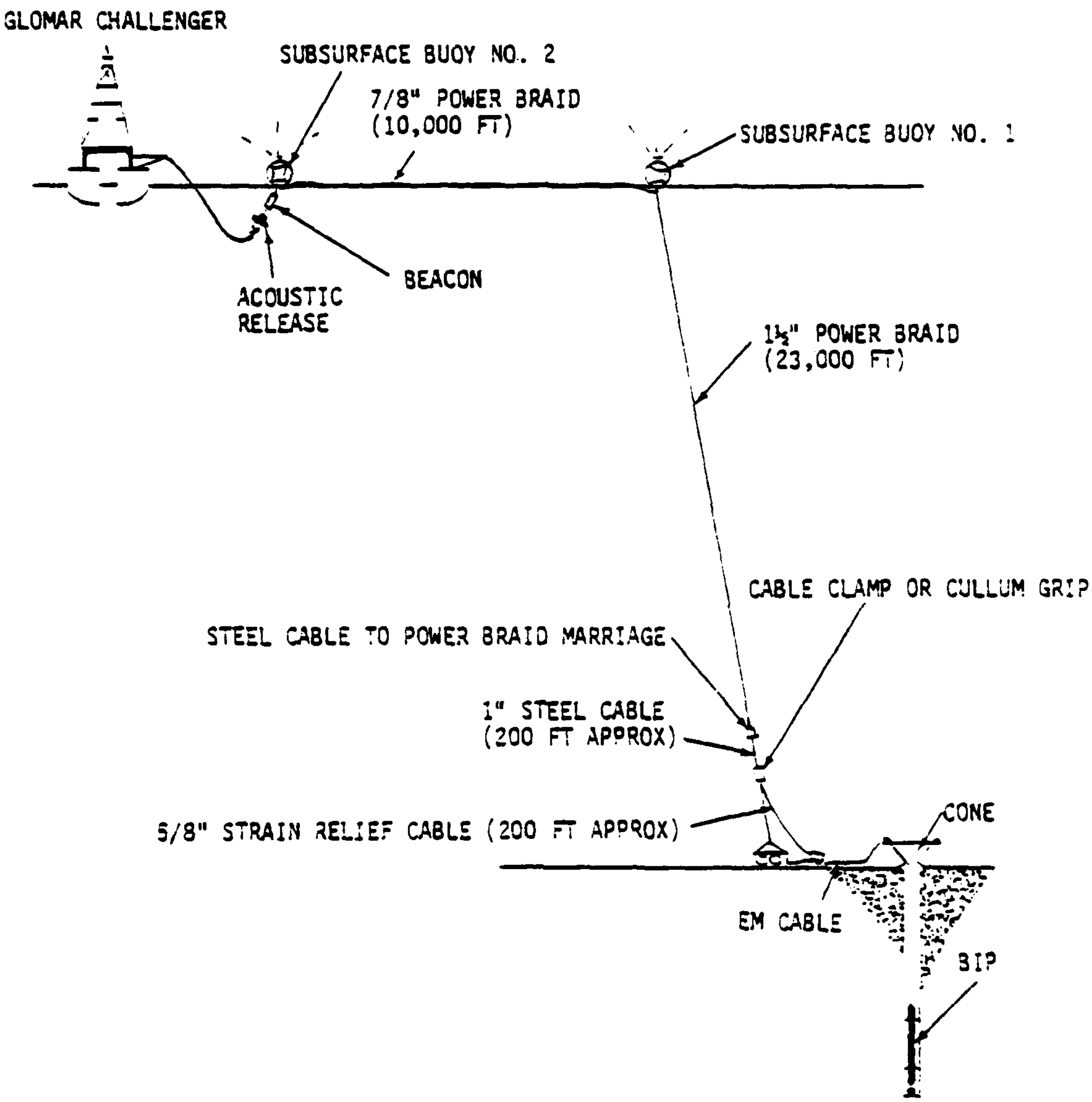

FIGURE 7-4 NO. 2 BUOY LAUNCH

7.4 NO. 2 BUOY AND ACOUSTICS RELEASE LAUNCH

.1 Steps

- Stop ship from drifting and hold position.
- Slack 7/8 in. Power Braid.
- Rig a steel sling with a Pelican Hook at the end and suspend on the crane whip line.
- Attach the Pelican Hook to the buoy assembly and pick up with crane.
- Attach the bitter end of the 7/8. in Power Braid to Buoy(s).
- Attach the Beacon and Acoustics Release to the buoy.
- Attach the 7/8 in Power Braid (anchor leg) to the latch on the Acoustics Release.
- Safety all shackles with seizing wire.
- Check systems for operational reliability.
- Pick the buoy assembly with crane, swing over the side and lower into the sea.
- Move the ship slowly downstream until all slack has been removed from the deployed line.
- Release the Pelican Hook and deploy the 18,000 ft. anchor leg moving downstream.

.2 Responsibility

- Rig Crew
- Ship's Crew
- Crane Operator
- Electronics Technician

.3 Operational Restrictions

- Sea State 4/5

.4 Precautions/Hazards

- Maintain lines clear of Thrusters and Screws.
- Use Tag Lines to avoid slamming systems against ship.
- Insure that the lines are not tangled with beacons.

.5 Special Equipment

- Pelican Hook and Tag Lines.

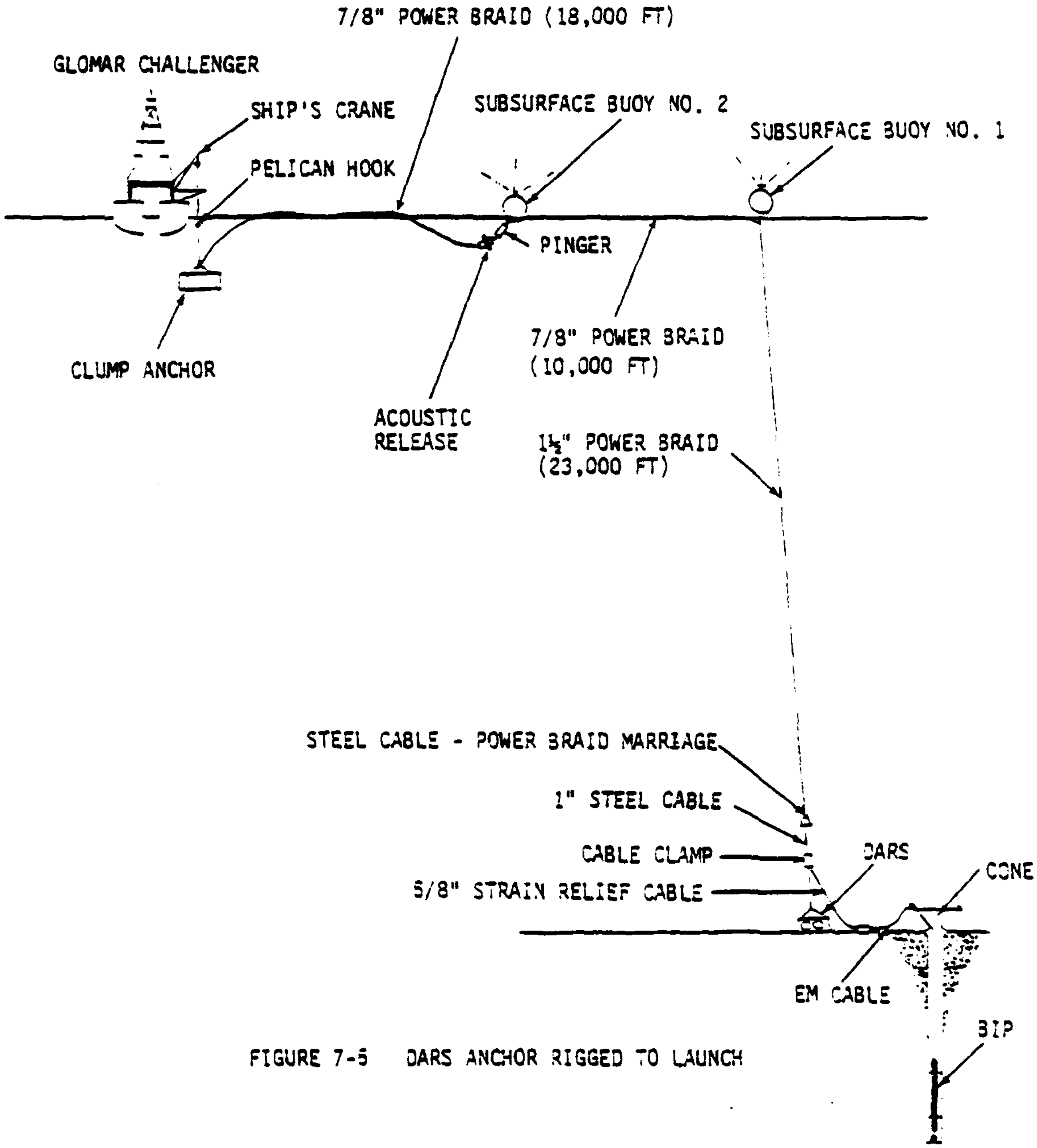

FIGURE 7-5 DARS ANCHOR RIGGED TO LAUNCH

006-063

7.5 IRR ANCHOR RIGGED TO LAUNCH

.1 Steps

- Stop ship and hold position.
- Remove bitter end of the 7/8 in. Power Braid from winch, out of the A-Frame Sheave and secure to ship's side.
- Rig a steel sling with a Pelican Hook attached, to the crane whip line and hook Pelican to the anchor.
- Attach the bitter end of the 7/8 in. Power Braid Line to the anchor.
- Safety the shackle with seizing wire.
- Pick the anchor with the crane, swing over the side and lower into the water.

.2 Responsibility - GMDC

- EM Winch Operator
- Rig Crew
- Ship's Crew
- Crane Operator
- GMDI Rep

.3 Operational Restrictions

- Sea State 4/5

.4 Precautions/Hazards

- Maintain the lines clear of thrusters and screws.
- Use Tag Lines to control when launching.

.5 Special Equipment

- None required.

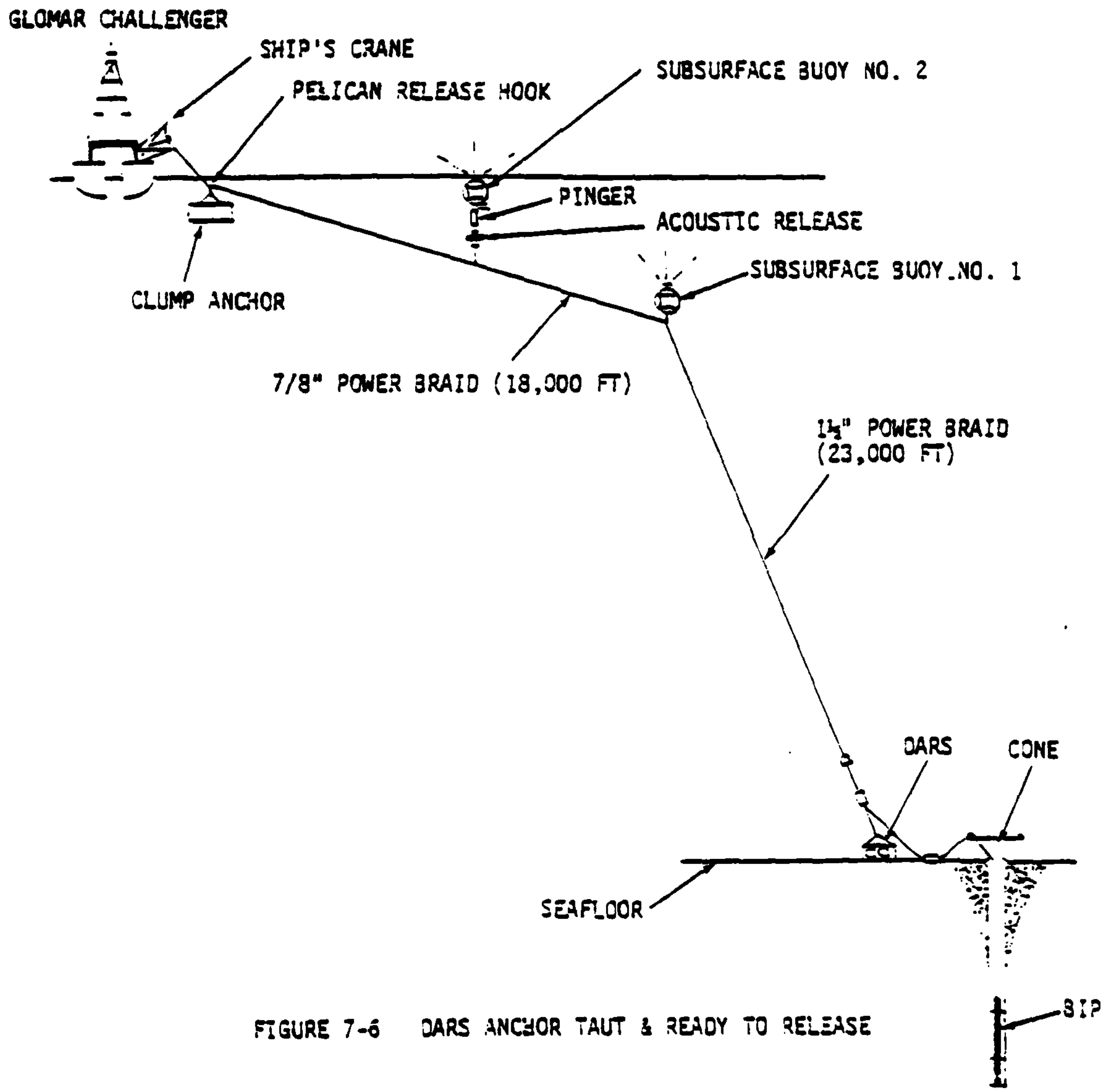

FIGURE 7-6 OARS ANCHOR TAUT & READY TO RELEASE

7.6 IRR ANCHOR TAUT AND READY TO RELEASE

.1 Steps

- Attach a snub line from the Whip/Load Line to the side of the ship and make fast.
- Drift ship slowly away until the Power Braid has become taut.
- Observe Buoys (if possible) and pull on the Power Braid until they are submerged.
- Trip Pelican Hook allowing anchor to free fall to seafloor.

.2 Responsibility - GMDC

- Rig Crew
- Ships Crew
- Crane Operator
- GMDI Engineer
- NORDA reps.

.3 Operational Restrictions

- Sea State 5

.4 Precautions/Hazards

Maintain lines clear of thrusters and ship's screws.

- Use a snub line to avoid overpulling on crane boom.
- Insure that all slack is removed from the deployed Power Braid.
- Do not pull sufficient to part the 7/8 in. Power Braid.
- Watch for backlash when the Pelican Hook is released.

.5 Special Equipment

- Snub Line from crane line to ships side.
- Field Glasses/Binocular to observe the buoys.

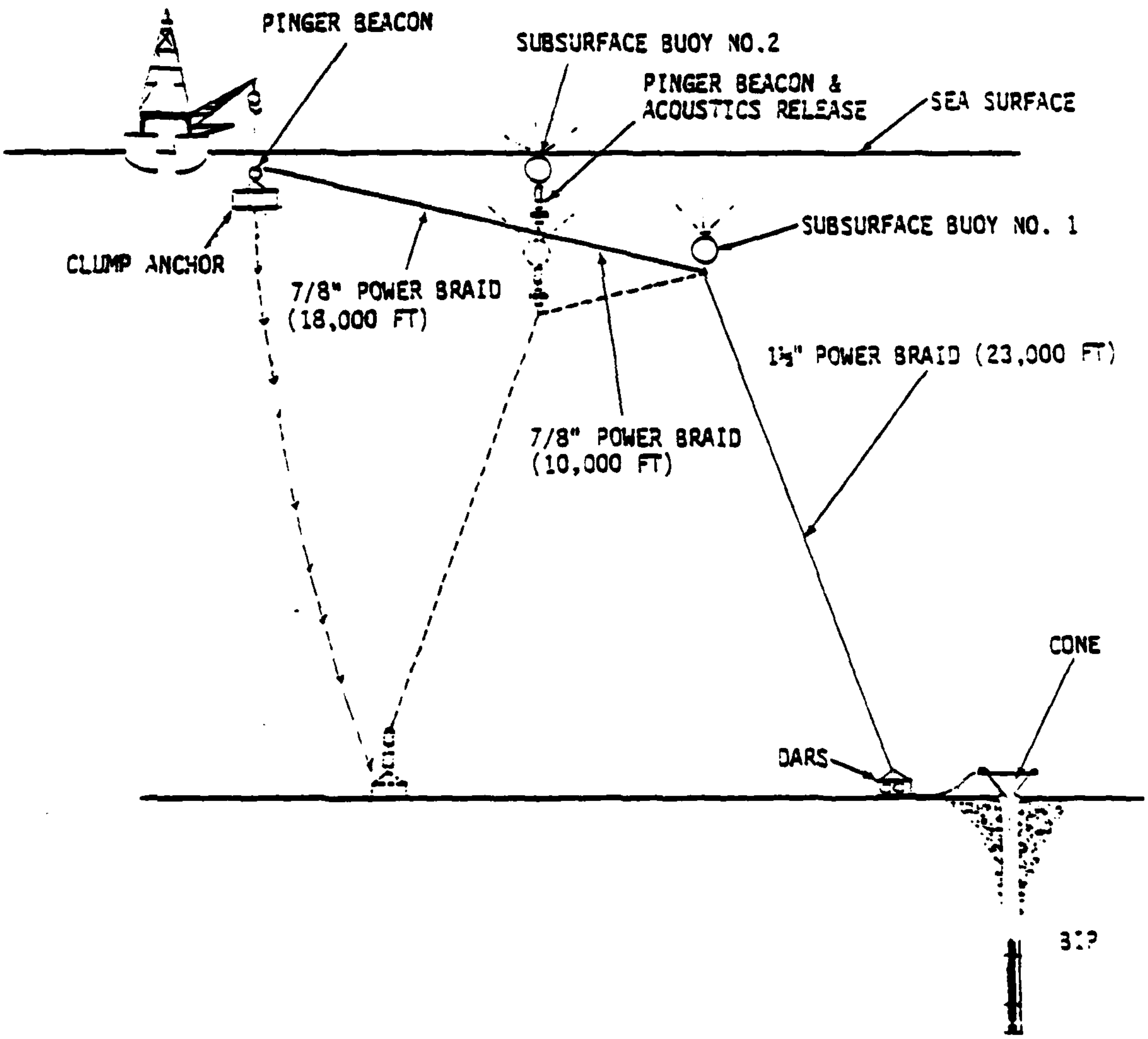

FIGURE 7-7 ANCHOR RELEASE & FALL TO SEAFLOOR

7.7 ANCHOR RELEASE AND FALL TO SEAFLOOR

.1 Steps

- Recover Pelican Hook and launching gear.
- Observe Buoys.
- Drop Marker Beacons as directed.

.2 Responsibility - GMDC

- Crane Operator
- Rig Crew
- GMDI Engineer
- NORDA Reps.

.3 Operational Restrictions

- Sea State 5

.4 Precautions/Hazards

- None

.5 Special Equipment

- None

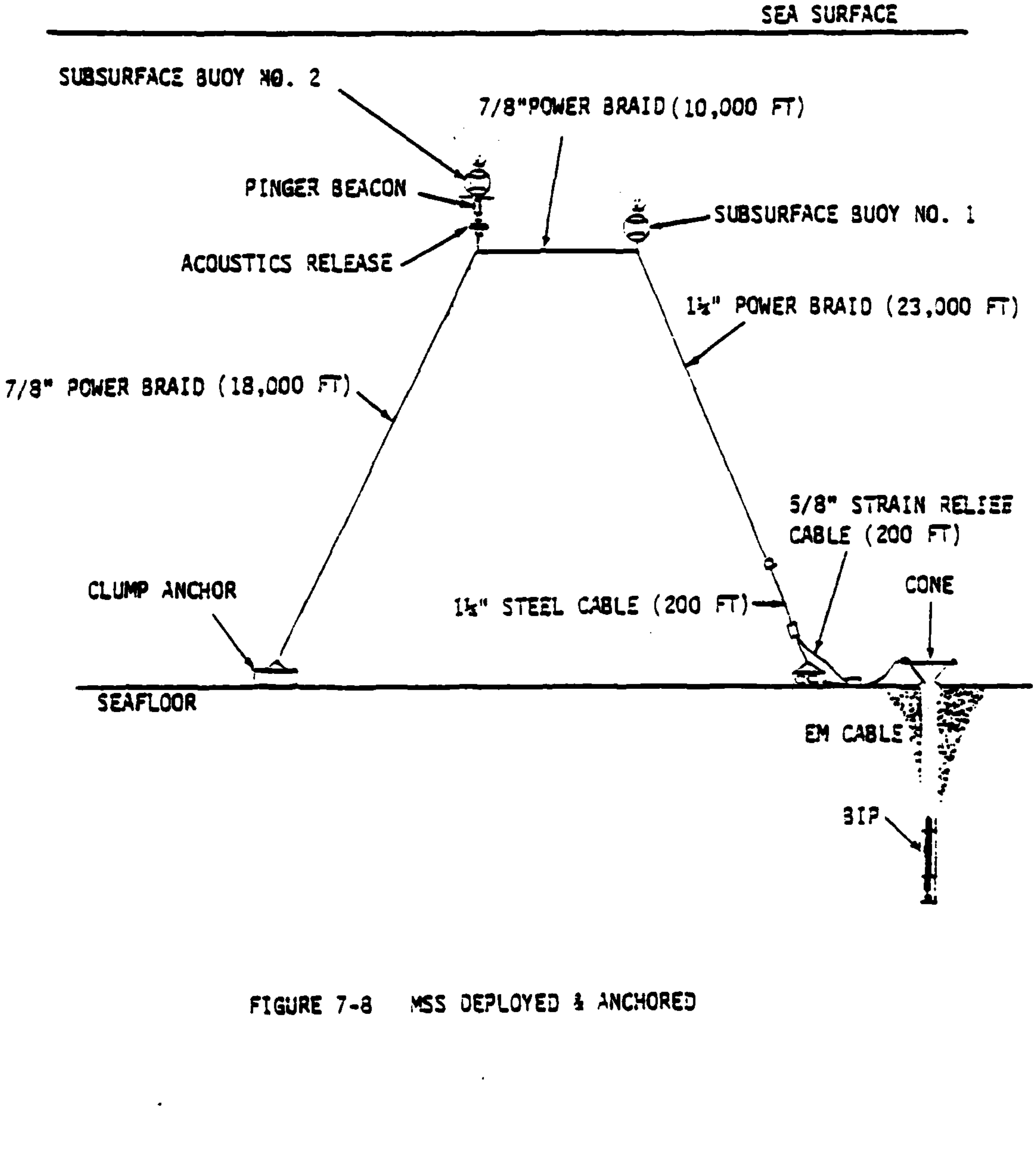

FIGURE 7-8 MSS DEPLOYED & ANCHORED

7.8 IRR DEPLOYED AND ANCHORED

.1 Steps

- Search the entire launch site to insure that, the Buoys are below the surface.
- Secure the ship and equipment for transi

.2 Responsibility - GMDC

- Ships Crew
- Rig Crew

.3 Operational Restrictions

- None

.4 Precautions/Hazards

- Post lookouts when searching for the buoys to insure against fouling in ships screws in the event the buoys are not submerged.

.5 Special Equipment

- Field Glasses (Binoculars)

INTENTIONALLY LEFT BLANK

8.0 DISENTANGLEMENT PROCEDURE

(TO BE SUPPLIED IN FINAL ISSUE,

INTENTIONALLY LEFT BLANK

9.0 DUAL SHIP PROCEDURE

(TO BE SUPPLIED IN FINAL ISSUE)

INTENTIONALLY LEFT BLANK

10.0 OPERATING INSTRUCTIONS FOR THE A-FRAME HEAVE COMPENSATOR

(TO BE SUPPLIED IN FINAL ISSUE)

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11.0 BPP LAUNCH INSTRUCTIONS

.1 Steps

- With the ship drifting downstream with current, pay out the EM Cable leaving approximately 100 ft (5 turns) on the winch drum.
- Unlock the Sheave Trolly and move the Sheave inboard to the work platform.
- Attach the permanent Cable Clamp No. 1 to the EM Cable approximately 5 ft below the A-Frame Sheave. The Clamp must be of sufficient strength to carry the total weight of the EM Cable (6,600 lbs) with a safety factor of 3.
- Connect the end of the 5/8 in. Diameter Strain Relief Cable to the eye of the Cable Clamp using a Safety Shackle. Safety the Shackle with Seizing Wire to insure against loosening when deployed.
- At approximately 65 ft up from the end of the 5/8 in. Strain Relief Cable, attach Clamp No. 2 for lifting of the EM Cable with the ship's crane. Cable Clamp No. 2 will be of the same strength as the No. 1.
- With the ship's crane, hook the Whip or Load Line into the lifting eye of the Clamp No. 2 and pick the load with the crane until there is slack on the EM Cable Winch being careful not to foul the Clamp No. 1 in the A-Frame Sheave.
- Lower the EM Cable with the ship's crane while paying out slowly on the EM Cable Winch until 1/2 turn remains on the winch drum. This will leave approximately 55 ft, of EM Cable to make the BPP connection and for the launch.
- When EM Cable is spaced out correctly, attach Cable Clamp No. 3 to the EM Cable and using steel slings and shackles, stop off to the padeye on the A-Frame.
- Stop Off the Strain Relief Cable Clamp No. 2 to the second padeye on the A-Frame using steel slings and shackles, and remove from the crane. This will serve as a safety support should there be a slippage of the EM Cable Clamps No's 1 or 3.
- Remove the Drum Clamp and Cable Connector from the EM Winch Drum, off of the Bull Wheels, out of the A-Frame Sheave and pass up to the BPP for final termination.

  NOTE: The slack line must be short enough to allow the crane to take the total weight of the EM Cable when the BPP package is lifted for launching. This should be approximately 50 ft.

- While the BPP is being hooked up and checked out, change out the sheave inserts or shieves to accommodate 1-1/4 in. Diameter Power Braid Line. The 1-1/4 in. will be OK for the 1 in. Cable if used.
- Pass the bitter end of the Launch Line from the shipping crate, around the winch drum 3 turns, over the Bull Wheels, through the Idler Shieve, over the A-Frame Shieve and up to the BPP for final connection.
- Shackle the end of the Launch Line to the BPP and safety the shackle with seizing wire or tack weld to insure against it's loosening when deployed.

  NOTE: The 1 in. steel cable if used, will be prespliced into the 1-1/4 in. Power Braid and will have an eye and thimble at the bitter end. The total line footage will be hand fed from the shipping crate out and over the winch drum during the deployment.
- Start the EM Cable Winch and haul in all slack in the Launch Line.
- Using a short steel strap, a Pelican Hook, a release messenger and three tag lines, pick the BPP package up with the ship crane, swing over the side and raise up until the EM Cable becomes tight and the Cable Clamps can be removed from the EM and the Strain Relief Cables.
- Attach a Tugger line or rope to the upper end of the strain relief cable for tailing out to it's termination point as the BPP is deployed.
- Remove the Cable Clamps from the EM Cable and the Strain Relief Cable (Clamp No.'s 2 & 3) and, the hang off rigging from the A-Frame. Stow all clamps and gear.
- Using Tie Wraps or other means, secure the Strain Relief Cable to the EM Cable and to the BPP Package as it is lowered.
- Check to insure that the Launch Line is properly reeved and is free to deploy.
- Swing the crane boom sufficient to clear the A-Frame with the BPP Package and lower the BPP into the water with the crane approximately 8 to 10 ft. Move Trolly out on A-Frame.
- Haul in on the EM Cable Winch until the Launch Line has taken the total load and release the Pelican hook.
- Lower the BPP slowly tieing off the Strain Relief Cable to the launch line until the bitter end is reached. Secure the bitter end to the launch line with a clamp or cullum grip.

- Deploy the BPP with the ship drifting downstream with the current, laying the EM Cable out on the seafloor in a direct line from the reentry cone.

  NOTE: The coordination between the winch operator and the bridge is critical to keep the tensions within safe limitsand to avoid disturbing the BIP.

- As the BPP nears the bottom, the deployment speed must be reduced to insure that a soft landing is made on the seafloor and no damage is sustained to the instruments.
- Continue the deployment until the 1-1/4 in. to 7/8 in. Power Braid spliced eyes pass over the A-Frame sheave.
- Stop the ship, back down until the 1-1/4 in. Power Braid is slack and maintain position.
- Unlock the A-Frame Trolly and move the shieve in to the working platform.
- Attach a rope stopper to the 1-1/4 in. Power Braid near the first spliced eye, secure to ship's side and slack the 7/8 in. Power Braid from the winch sufficient to work.
- Using the ship's crane, pick the A Buoys and attach to the prespliced eyes in the Power Braid Line securing shackles with Seizing Wire. Attach a pelican Hook Release, slings and a release messenger line, pick the Buoys, swing over the side and lower into the water. Move trolly out on A-Frame.
- Drift the ship slowly away until the deployed line is taunt, release the Pelican Hook and begin the deployment of the 7/8 in. Power Braid.
- Deploy the 7/8 in. Power Braid (Grappnel Leg) drifting the ship slowly downstream to the current and in a direct line away from the re-entry cone.

  NOTE: The coordination between the Bridge and the Winch Operator is critical to avoid overpulling on the line. Observation of the Buoys may assist the control during this step.

- Stop the ship and hold position before the bitter end of the 7/8 in. Power Braid is paid out of the shipping crate. Move the A-Frame Trolly in to the work platfomr. Pay out the 7/8 in. line until the prespliced eyes are passing over the Bull Wheels and stop off the line to the side of the ship.
- Remove the line from the winch, out of the A-Frame Sheave and over to the main deck work area.

- Attach the Buoys to the prespliced eyes and secure shackles with seizing wire. At the end of the Grappnel Leg, attach the Pinger then, the Acoustics Release and secure with seizing wire. Check the release systems for operation.
- Reeve the upper end of the 7/8 in. Power Braid (anchor leg) through the winch, over the A-Frame Shieve and connect the eye to the bottom of the Acoustics Release.
- Pick the B-Buoys with the ships crane using a Pelican Hook, Steel sling, a release messenger and tag lines. Move the A-Frame Trolly out to the end and lock. Drift the ship slowly removing the slack from the deployed line, while lowering the buoys into the water.
- Prepare the winch for deployment, check for proper reeving and trip the Pelican hook when line is taunt.
- Deploy the 18,000 ft of 7/8 in. Power Braid (anchor leg) as before until approximately 100 ft. of line remains on the winch.
- Stop the ship, holding position, move the A-Frame Trolly in to the working platform and stop off the 7/8 in. line to the side of the ship.
- Remove the 7/8 in. line from the winch, out of the A-Frame Shieve and connect the bitter end to the expendable anchor. Secure shackle pin with seizing wire or tack weld.
- Rig the ships crane with a steel sling, a pelican hook attached to the anchor, a release messenger and tag lines.
- Pick the anchor up, swing over the side and lower into the waters surface.
- Move the ship slowly downstream with the current until the slack is removed from the deployed line. Increase the strain on the deployed line until it is well tensioned observing the load applied on the crane line.

  CAUTION! Observe the crane and do not overload the boom.
- When the systems are sufficiently tight, trip the Pelican Hook and allow the Anchor to fall freely to bottom, pulling the Buoys under the surface to a prescribed depth.
- Cruise the launch site to insure that the buoys have been submerged below the sea surface.
- Deploy ATNAV Transponders according to the recovery navigation planning.

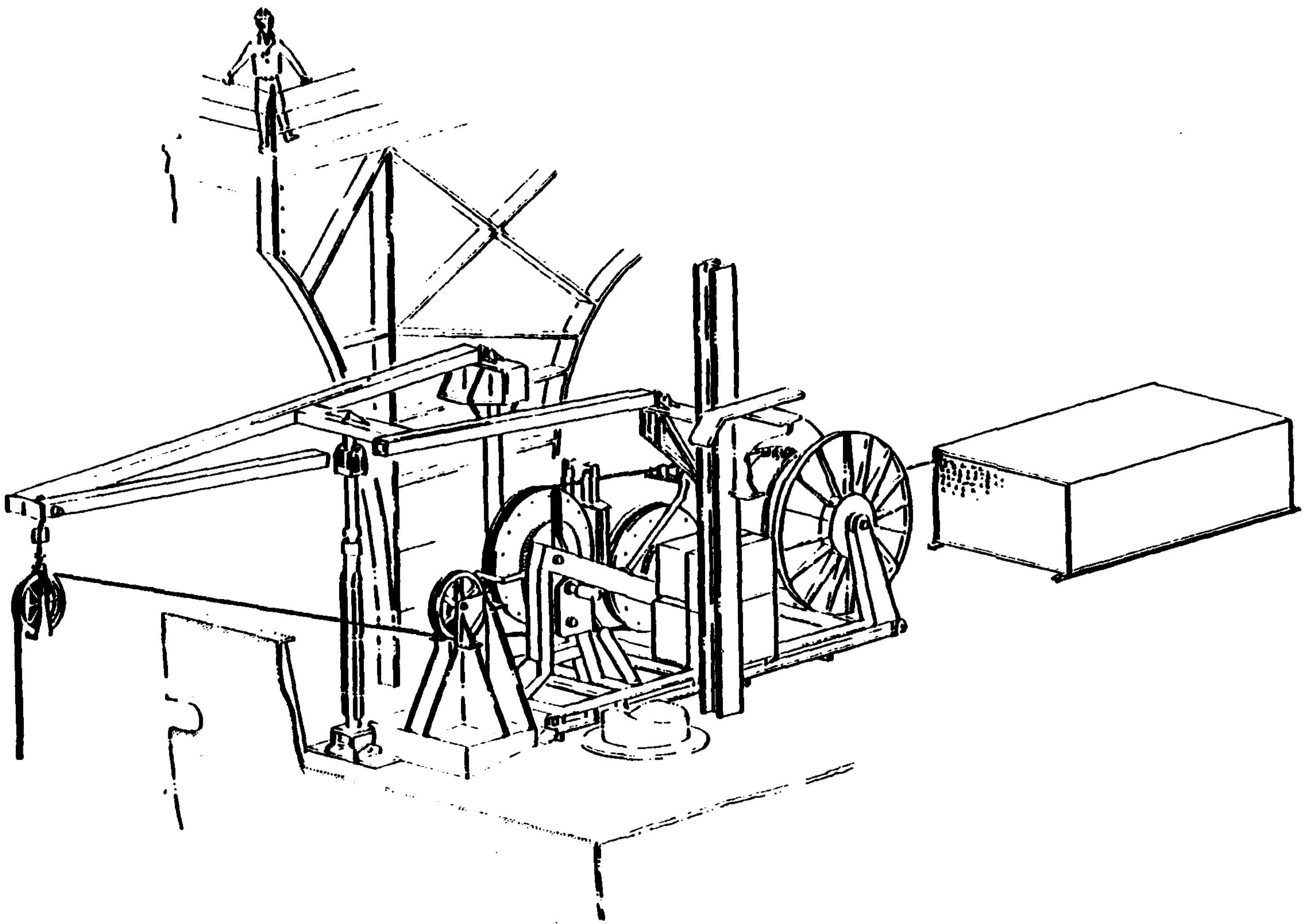


FIGURE 11-1   TRACTION WINCH REEVED TO DEPLOY POWER BRAID

0006-039

APPENDIX D

MSS CONFIGURATION I MODIFIED DRAWING LIST

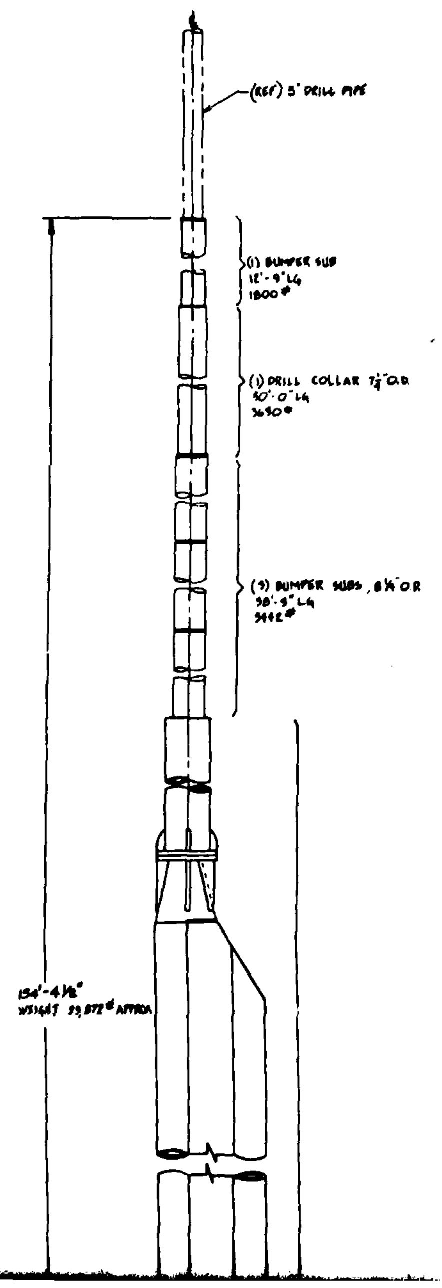
APPENDIX D

MSS CONFIGURATION I - MODIFIED DRAWING LIST

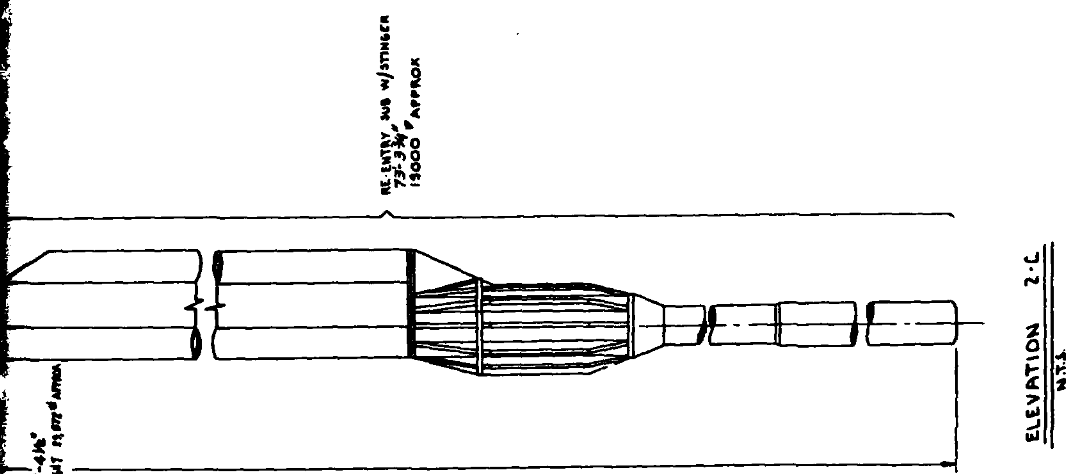
DRAWING NO.	TITLE	REV
MSSA02-MTL-D001	MSS '82 BIP REENTRY SUB WITH STINGER CONTROL DRAWING	0
MSSA02-MTL-D002	MSS '82 REENTRY ASSEMBLY CONTROL DRAWING	0
MSSA02-MTL-D003	MSS '82 BIP CARRIAGE CONTROL SUB DETAILS AND ASSEMBLY	0
MSSA02-MTL-D004	MSS '82 BIP CARRIAGE HOUSING ASSEMBLY AND DETAILS	0
MSSA02-MTL-D006	MSS '82 BIP CARRIAGE HOUSING MAIN ASSEMBLY	0
MSSA02-MTL-D007	MSS '82 BIP REENTRY TOOL ASSEMBLY	0
MSSA02-MTL-D008	MSS '82 HYDRAULIC PLUG/SONAR ADAPTOR MODIFICATION	0
MSSA02-MTL-D009	MSS '82 DUMMY SONAR REENTRY TOOL	0
MSSA02-MTL-D010	MSS '82 IDLER SHEAVE SUPPORT DETAILS & ASSEMBLY	0
MSSA02-MTL-D011	MSS '82 SONAR SINKER BAR ASSEMBLY & DETAILS	0
MSSA02-MTL-D012	MSS '82 REENTRY SUB STINGER ASSEMBLY & DETAILS	0
MSSA02-MTL-D013	MSS '82 BAKER VALVE & SINKER BAR ADAPTOR MODIF., DETAILS & ASSEMBLY	0

A B C D

6 5 4



(REF) 5" DRILL PIPE
(1) BUMPER SUB
12'-9" LG
1800#
(1) DRILL COLLAR 7 3/4" OD
30'-0" LG
3630#
(3) BUMPER SUBS, 8 1/4" OD
38'-3" LG
5412#
154'-4 1/2"
WEIGHT 33,872# APPROX



REFERENCE DRAWINGS:

1. E-001-A003 BIP CARRIAGE CONTROL SUB DETAILS AND ASSY.
2. E-001-A012 BIP CARRIAGE HOUSING ASSY & DETAILS.
3. MSSA02-MTL-D004 MODIFIED BIP CARRIAGE HOUSING ASSY. & DETAILS.
4. MSSA02-MTL-D012 REENTRY TOOL STINGER ASSY & DETAILS

			ADDED "CONTROL DRAWING" TO TITLE (ZONE 1-A). REFERENCE DWG #4 (ZONE 1-B) REVISED DWG # FROM MSSA02-MTL-D005 TO MSSA02-MTL-D012.	
O	12-18-81	CP	DESIGN RELEASE	0H/4110
A	5-20-81	GD	PRELIMINARY RELEASE	00X/3000

RELEASED TO DESIGN BASELINE — FOR CONSTRUCTION —

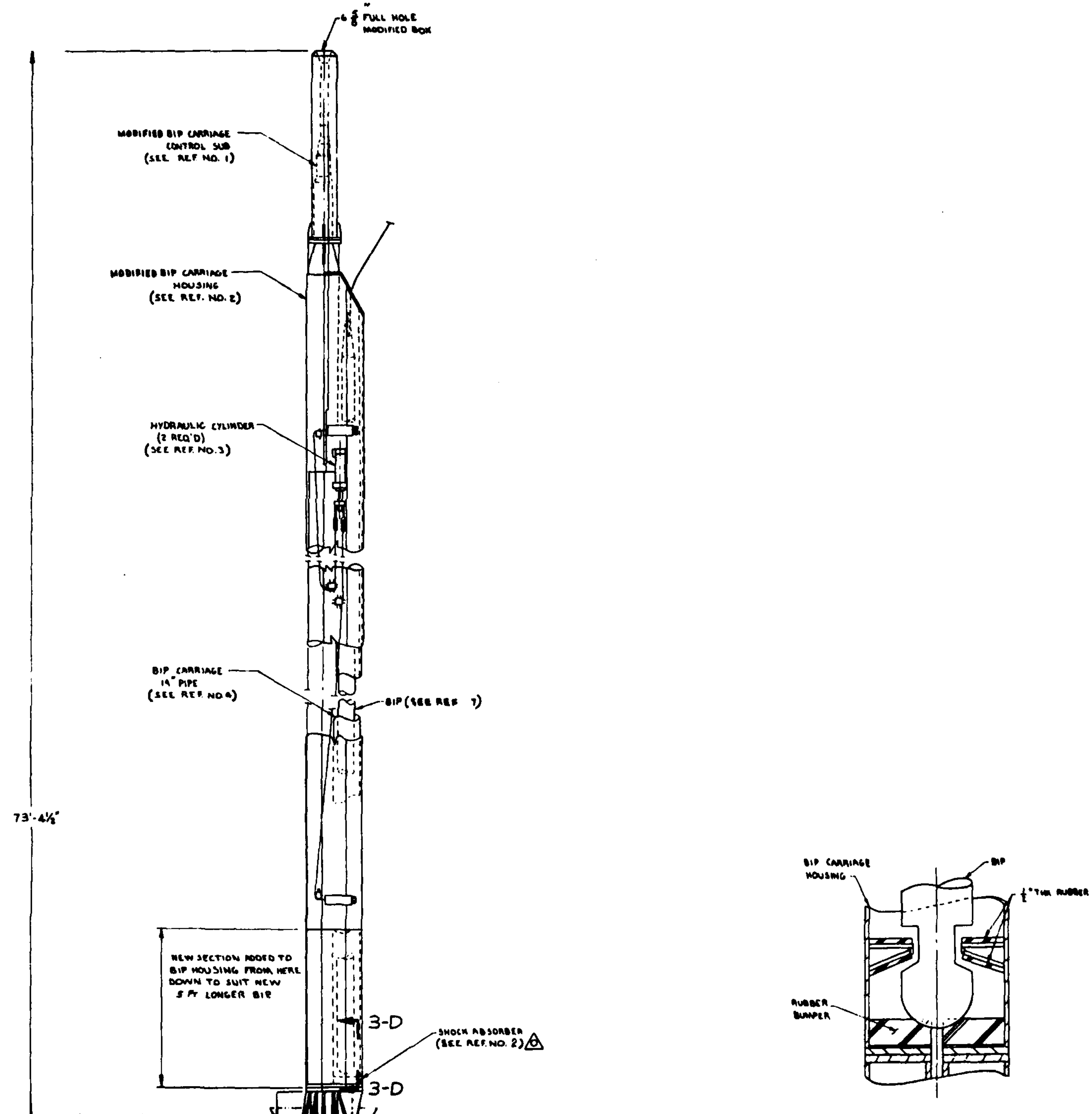
GLOBAL MARINE DEVELOPMENT Inc.

MARINE SEISMIC SYSTEM (MSS)-RE
MODIFIED REENTRY
ASSEMBLY CONTROL DRAWING

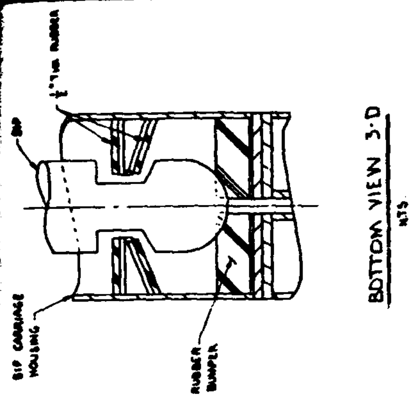
D WEST

SCALE NONE

E MSSA02-MTL-D002 O



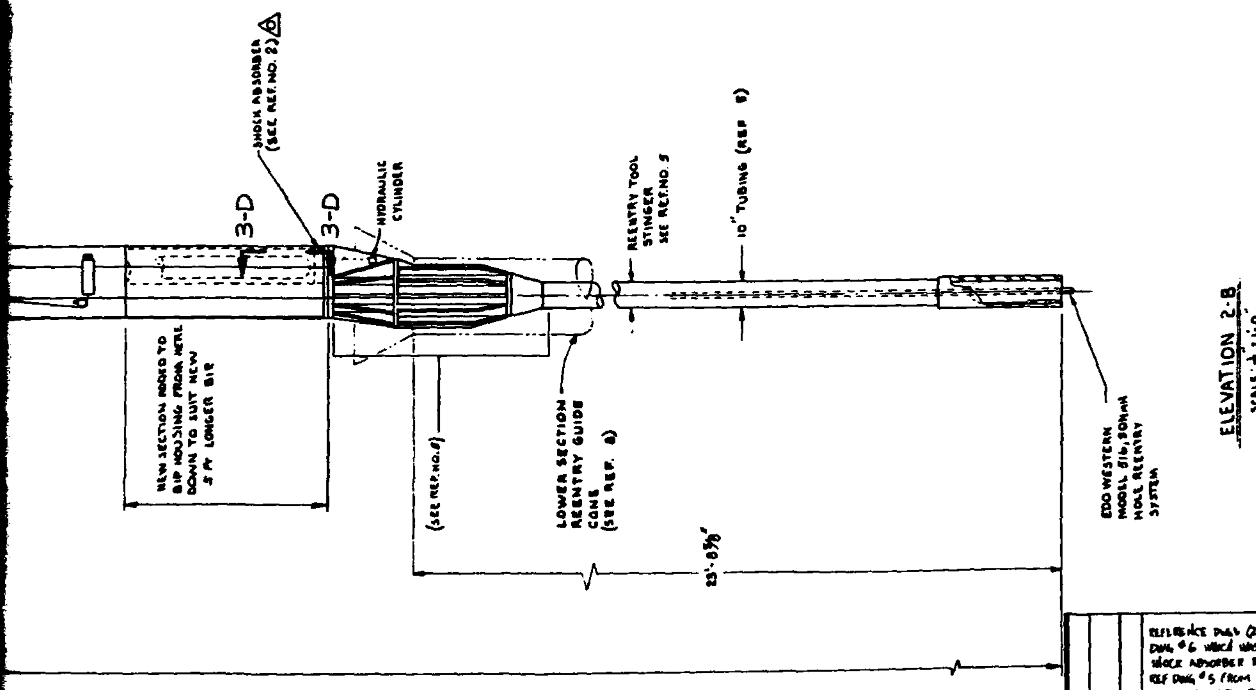
6 5/8" FULL HOLE MODIFIED BOX
MODIFIED BIP CARRIAGE CONTROL SUB (SEE REF NO. 1)
MODIFIED BIP CARRIAGE HOUSING (SEE REF. NO. 2)
HYDRAULIC CYLINDER (2 REQ'D) (SEE REF. NO. 3)
BIP CARRIAGE 14" PIPE (SEE REF. NO. 4)
BIP (SEE REF 7)
73'-4½"
NEW SECTION ADDED TO BIP HOUSING FROM HERE DOWN TO SUIT NEW 5 FT LONGER BIP
3-D
SHOCK ABSORBER (SEE REF. NO. 2)
3-D
BIP CARRIAGE HOUSING
BIP
½" THK RUBBER
RUBBER BUMPER



BOTTOM VIEW 3-D
NTS

REFERENCE DWGS:

1. MSSA02-MTL-0003 BIP CARRIAGE CONTROL SUB, DETAILS AND ASSEMBLY
2. MSSA02-MTL-0004 MODIFIED BIP CARRIAGE HOUSING, ASSEMBLY AND DETAILS.
3. MSSA02-MTL-0006 MODIFIED BIP CARRIAGE HOUSING, MAIN ASSEMBLY
4. D-001-A004 BIP CARRIAGE ASSEMBLY AND DETAILS.
5. MSSA02-MTL-0012 REENTRY TOOL STINGER, ASSEMBLY AND DETAILS.
6.
7. 990-53100 BIP (TELEDYNE GEOTECH)
8. E-001-SK06 CONE AND 11 3/4"-16" CASING HANGER ASSEMBLY



ELEVATION 2-B
SCALE: $\frac{1}{2}$" = 1'-0"

0	12-1-81	CP	REFERENCE DWGS (ZONE 1-C): DELETED REF DWG #6 WHICH WAS C-001-A006 LATERAL SHOCK ABSORBER RING DETAIL, AND REVISED REF DWG #5 FROM MSSA02-MTL-0005 TO MSSA02-MTL-0012. ELEVATION 2-B (ZONE 1-B): REVISED SEE REF NO. 6 TO SEE REF DWG No. 2. DESIGN RELEASE	011/4110
A	9-21-81	GD	PRELIMINARY RELEASE	006/3100

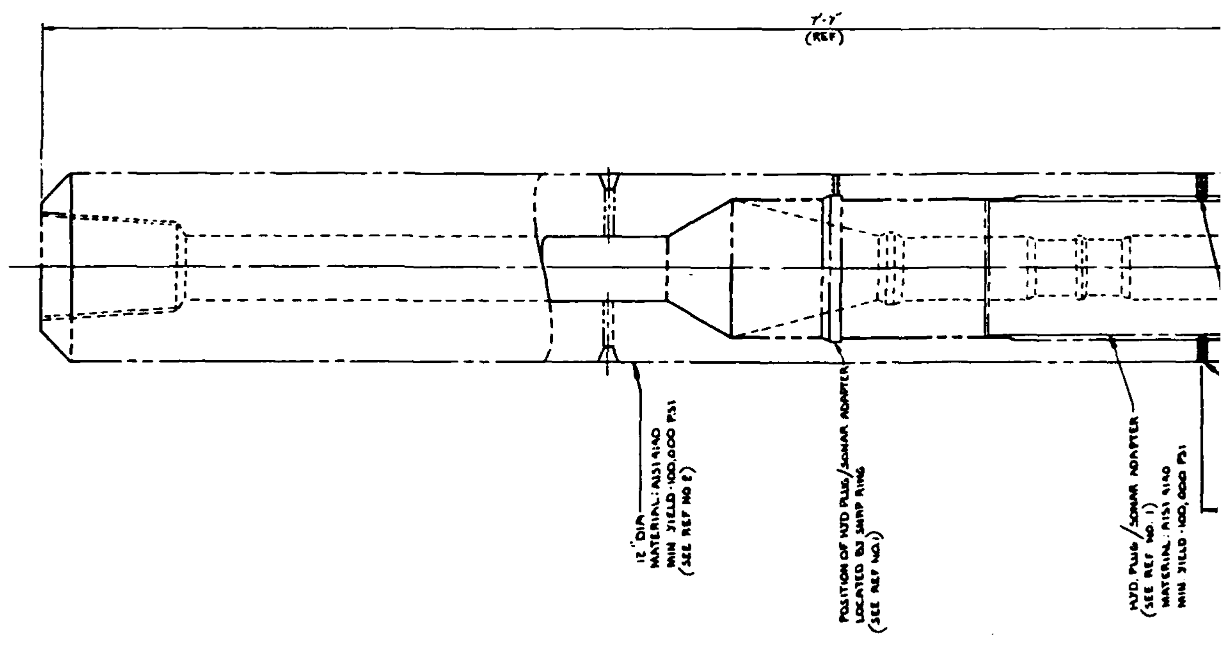
RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

GLOBAL MARINE DEVELOPMENT Inc.
Newport Beach, Calif.

MARINE SEISMIC SYSTEMS (MSS) - 82
MODIFIED BIP REENTRY SUB WITH STINGER
CONTROL DRAWING

DR G. D. 9-17-81
D WEST
SCALE AS NOTED
SIZE E
MSSA02-MTL-0001
REV 0

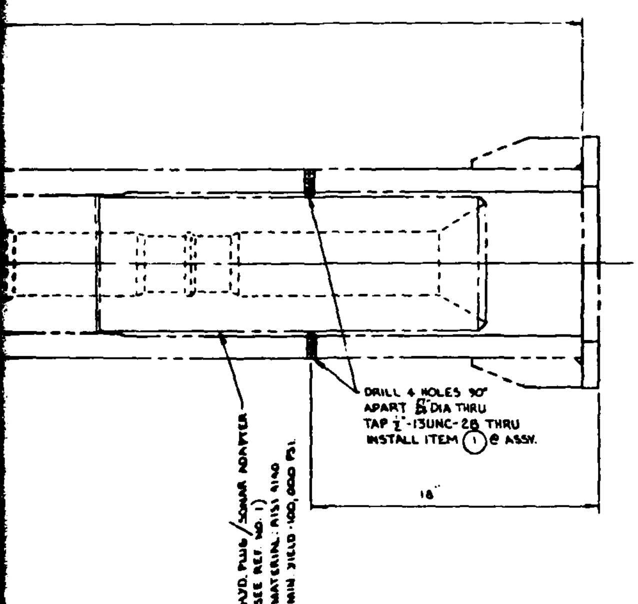
1 2 3


7'-7"
(REF)
12" DIA
MATERIAL: AISI 4140
MIN YIELD 100,000 PSI
(SEE REF NO 2)
POSITION OF HYD PLUG/SONAR ADAPTER
LOCATED BY SNAP RING
(SEE REF NO. 1)
HYD. PLUG/SONAR ADAPTER
(SEE REF NO. 1)
MATERIAL: AISI 4140
MIN YIELD 100,000 PSI

DETAIL 4-B

LIST OF MATERIALS

	Item	Qty	Description	Material
	1	4	½"-13UNC-2A × 1⅜" LG SET SCREW, ALLEN HEAD SELF LOCKING	S.S.T.



GENERAL NOTES: (UNLESS OTHERWISE NOTED)

1. THE PURPOSE OF THIS DWG IS TO GIVE DETAILS FOR SECURING HYDR PLUG SONAR ADAPTER IN POSITION SEE REF. 2
2. THIS DWG IS MODIFIED AND WAS DEVELOPED FROM REF #2, ALT #1. ALL OTHER DIMENSIONS ARE SHOWN ON THAT DRAWING.
3. ASSEMBLY TO BE SECURED AS SHOWN.

REFERENCE DWGS.

1. MSSA02-MTL-D008 HYDRAULIC PLUG/SONAR ADAPTER MODIFICATION
2. E-001-A005 (MSS) BIP CARRIAGE CONTROL SUB DETAILS AND ASSEMBLY

RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

MSSA02-MTL-D001

Rev	Date	By	Description	
O	9/18/81	CP	DESIGN RELEASE	011/9110
A	9/2/81	GD	PRELIMINARY RELEASE	006/9100

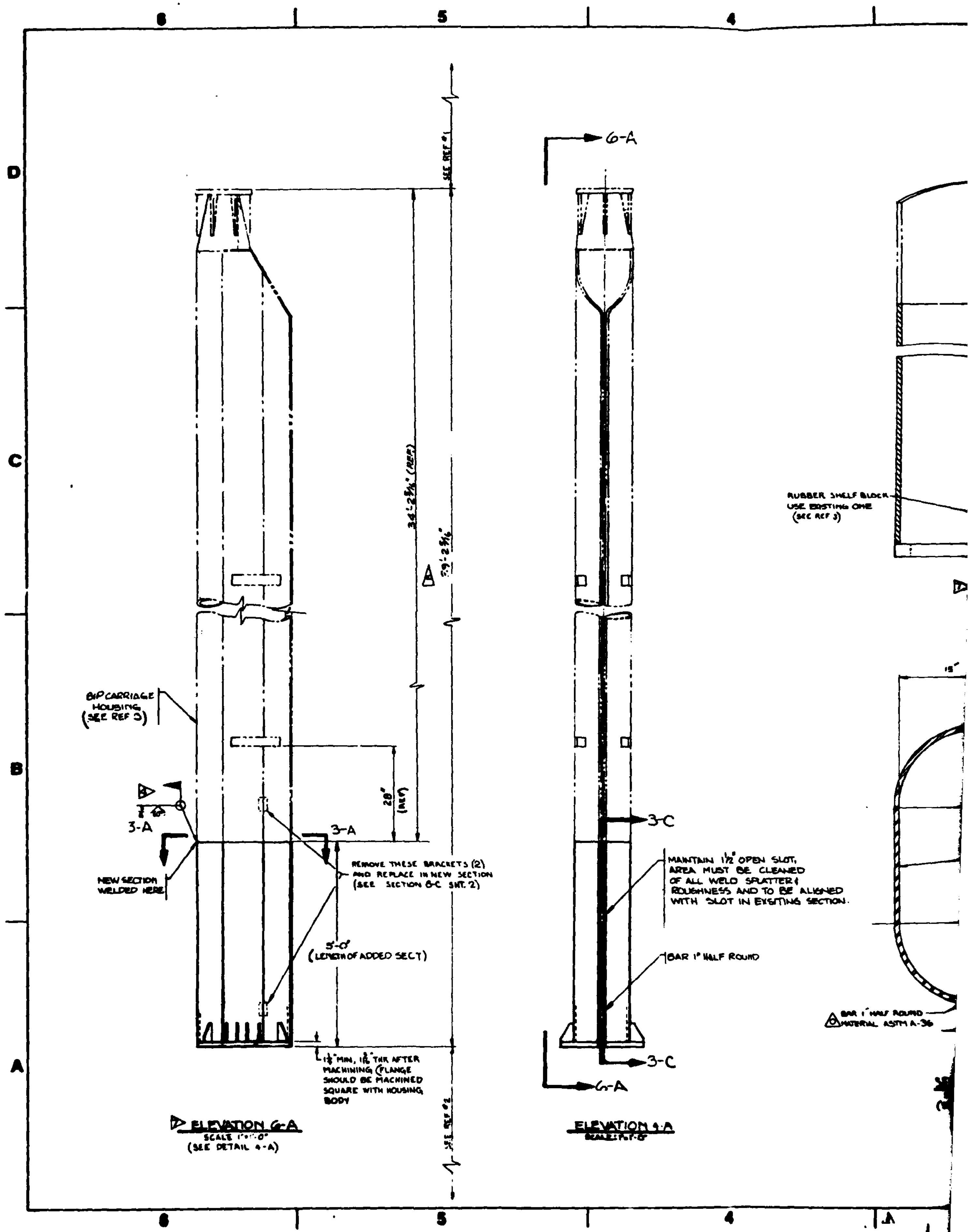
GLOBAL MARINE DEVELOPMENT Inc.
Newport Beach, Calif.

MARINE SEISMIC SYSTEMS (MSS)-BB
BIP CARRIAGE CONTROL SUB
DETAIL & ASSEMBLY

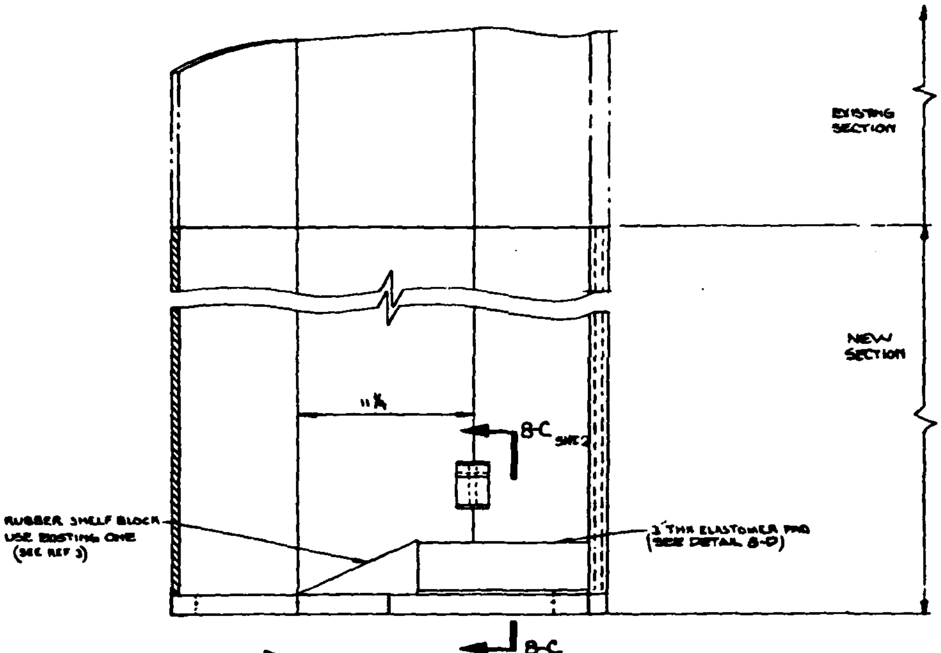
D. WEST
9-17-81

E MSSA02-MTL-D008

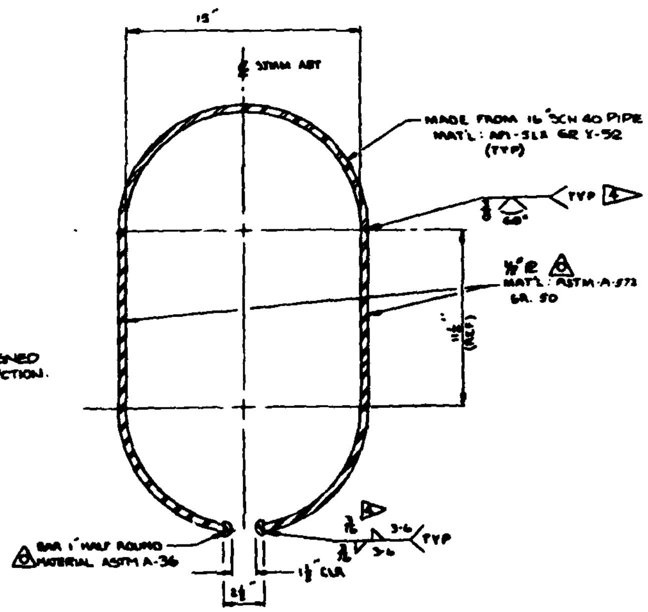
1 2


6-A
SEE REF #1
34'-2 3/16" (REF)
39'-2 3/16"
BIP CARRIAGE HOUSING (SEE REF 3)
28" (REF)
3-A
3-A
NEW SECTION WELDED HERE
REMOVE THESE BRACKETS (2) AND REPLACE IN NEW SECTION (SEE SECTION 6-C SHT. 2)
5'-0" (LENGTH OF ADDED SECT)
1 1/2" MIN, 1 5/8" THK AFTER MACHINING (FLANGE SHOULD BE MACHINED SQUARE WITH HOUSING BODY
ELEVATION 6-A
SCALE 1"=1'-0"
(SEE DETAIL 4-A)
SEE REF #2
3-C
MAINTAIN 1 1/2" OPEN SLOT, AREA MUST BE CLEANED OF ALL WELD SPLATTER & ROUGHNESS AND TO BE ALIGNED WITH SLOT IN EXISITING SECTION.
BAR 1" HALF ROUND
3-C
6-A
ELEVATION 6-A
RUBBER SHELF BLOCK USE EXISTING ONE (SEE REF 3)
15"
BAR 1" HALF ROUND MATERIAL ASTM A-36
6
5
4
D
C
B
A

LIST OF MATERIALS



SECTION 3-C
SCALE: 3"-1'-0"
(SEE ELE. 4-A)



SECTION 3-A
SCALE 3"-1'-0"
(SEE ELEV. 6A)

...PEN SLOT,
...E CLEANED
...SPATTER)
...AND TO BE ALIGNED
...N EXISTING SECTION.

GENERAL NOTES

1. ALL WELDING TO BE IN ACCORDANCE WITH AWS D1.1 STRUCTURAL WELDING CODE-STEEL.
2. BREAK ALL SHARP EDGES AND REMOVE ALL BURRS.
3. ALL MACHINE SURFACES TO BE 125
4. ALL WELDS THIS ASSEMBLY TO USE E7018 ELECTRODE EXCEPT AT END FLANGES A-633 ARE TO BE WELDED WITH E8018-C3 ELECTRODE AND PRE HEAT @ 175°F.
5. THIS DWG WAS DEVELOPED FROM REF. 3. DIMENSIONS NOT SHOWN ON THIS DWG ARE SHOWN ON REF 3.
6. THIS DWG SHOWS THE MODIFICATIONS NECESSARY TO MAKE THE BIP CARRIAGE HOUSING OF REF. 3 CAPABLE OF TAKING THE NEW 5'-11 ⅜" LONGER BIP.
7. ADDED SECTION OF BIP CARRIAGE HOUSING SHOWN SOLID.
8. THIS DIMENSION TO BE STRICTLY ADHERED TO AND SHOULD BE VERIFIED BY GMDI REP.
9. PAINT IN ACCORDANCE WITH GMDI SPEC 001-002.

REFERENCE DRAWING:

1. MSSA02-MTL-0003 BIP CARRIAGE CONTROL SUB DETAIL AND ASSEMBLY
2. MSSA02-MTL-0002 REENTRY TOOL STINGER ASSEMBLY & DETAILS
3. E-001-A012 BIP CARRIAGE HOUSING ASSEMBLY & DETAILS

			REMOVED PART OF GENERAL NOTE 7 (ZONE 1-C, SH 1) WHICH STATED: TO BE OF SIMILAR MATERIALS AS ORIGINAL HOUSING. VIEW 11-C (ZONE 11-C, SH 2): REVISED ASTM A-63 CALLOUT TO ASTM A-633 AND ADDED ADDITIONAL CALLOUT FOR MAT'L ASTM A-572 GR 50. VIEW 11-C (ZONE 10-C, SH 2): REMOVED CALLOUT FOR ¾" R MAT'L ASTM A-36 (R ROUND) & GRIND SMOOTH APPROX ¾" R. SECTION 3-A (ZONE 3-A, SH 1): ADDED MAT'L ASTM A-36 CALLOUT FOR 1" HALF ROUND BAR & ADDED ⅜" R CALLOUT FOR MAT'L ASTM A-572. REVISED LENGTH OF BIP IN GENERAL NOTE 6 (ZONE 1-C, SH 1) FROM 5 FT TO 5'-11⅜".		
		CP	DESIGN RELEASE.	011/4110	
A	4/26	CP	PRELIMINARY RELEASE	006/3100	

RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

MSSA02-MTL-0001

GLOBAL MARINE DEVELOPMENT Inc.
Newport Beach, Calif.

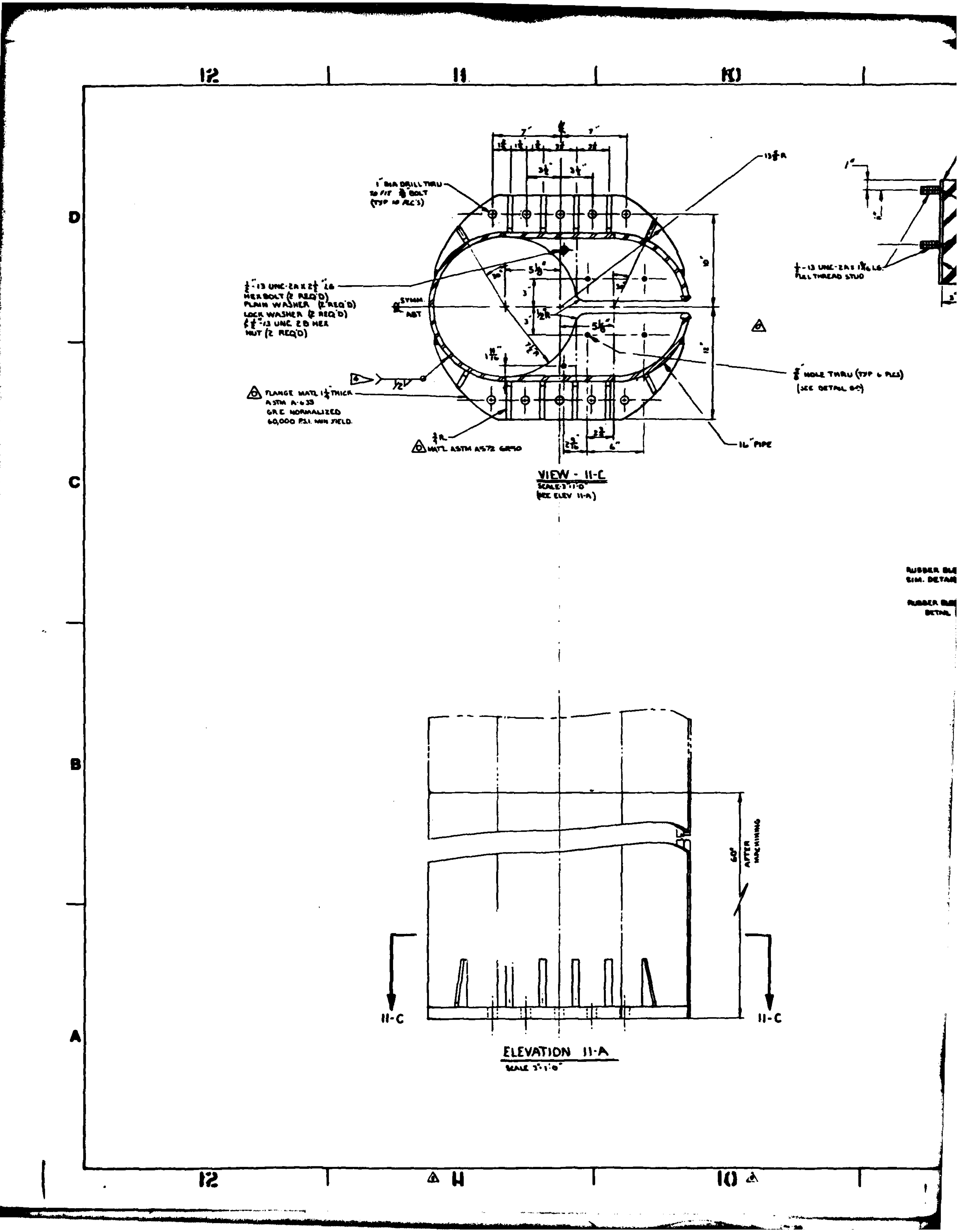
MARINE SEISMIC SYSTEM (MSS)
MODIFIED BIP CARRIAGE HOUSING
ASSEMBLY AND DETAILS

SCALE: AS NOTED

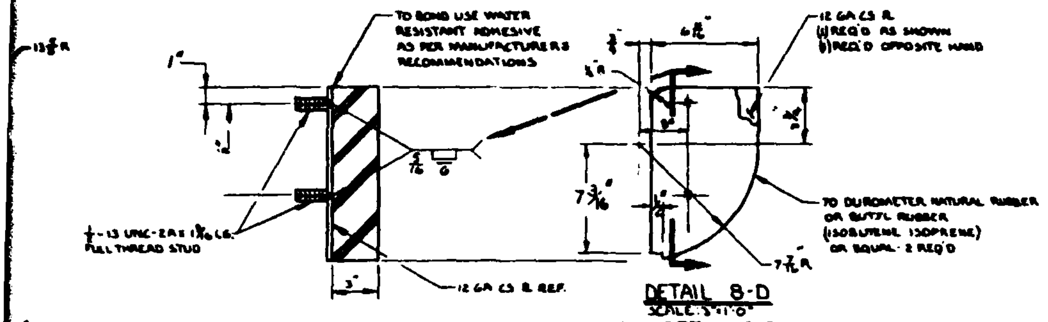
SIZE: E — MSSA02-MTL-0006

3 2 1

12

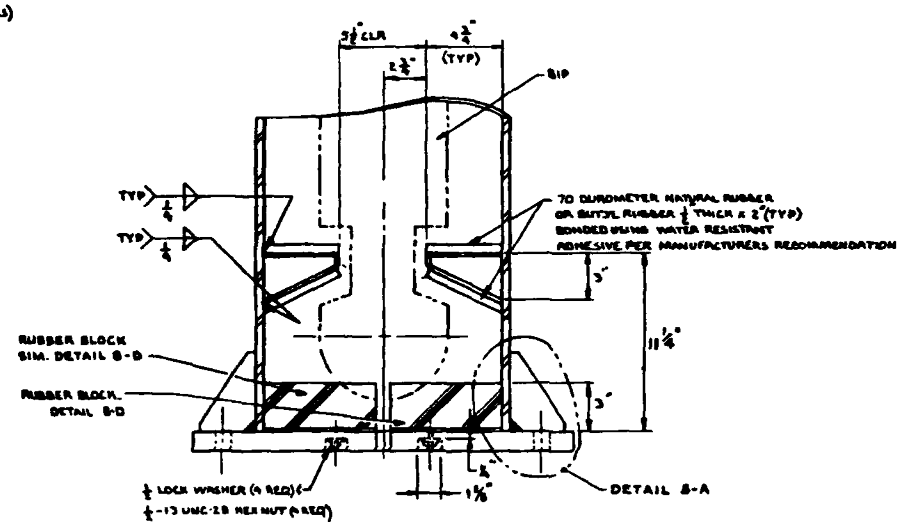


12
11
10
D
C
B
A
1" DIA DRILL THRU TO FIT 7/8" BOLT (TYP 10 PLC'S)
1/2"-13 UNC-2A X 2 1/2" LG HEX BOLT (2 REQ'D) PLAIN WASHER (2 REQ'D) LOCK WASHER (2 REQ'D) 1/2"-13 UNC 2B HEX NUT (2 REQ'D)
SYMM ABT
FLANGE MATL 1 1/2" THICK ASTM A-633 GR C NORMALIZED 60,000 PSI MIN YIELD
MATL ASTM A572 GR50
16" PIPE
HOLE THRU (TYP 6 PLCS) (SEE DETAIL 6-)
FULL THREAD STUD
VIEW - 11-C
SCALE 3"=1'-0"
(SEE ELEV 11-A)
60" AFTER MACHINING
11-C
11-C
ELEVATION 11-A
SCALE 3"=1'-0"
RUBBER BLE
SIM. DETAIL
H

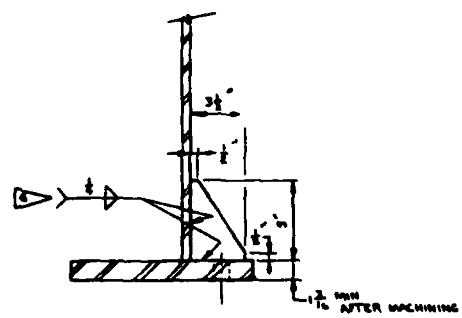


DETAIL 8-D
SCALE: 3"=1'-0"
SIM. DETAIL 8-D
OPPOSITE HAND

HOLE THRU (TYP 6 PLCS)
(SEE DETAIL 8-D)



SECTION 8-C
SCALE: 3"=1'-0"
SEE SECT. 8-C



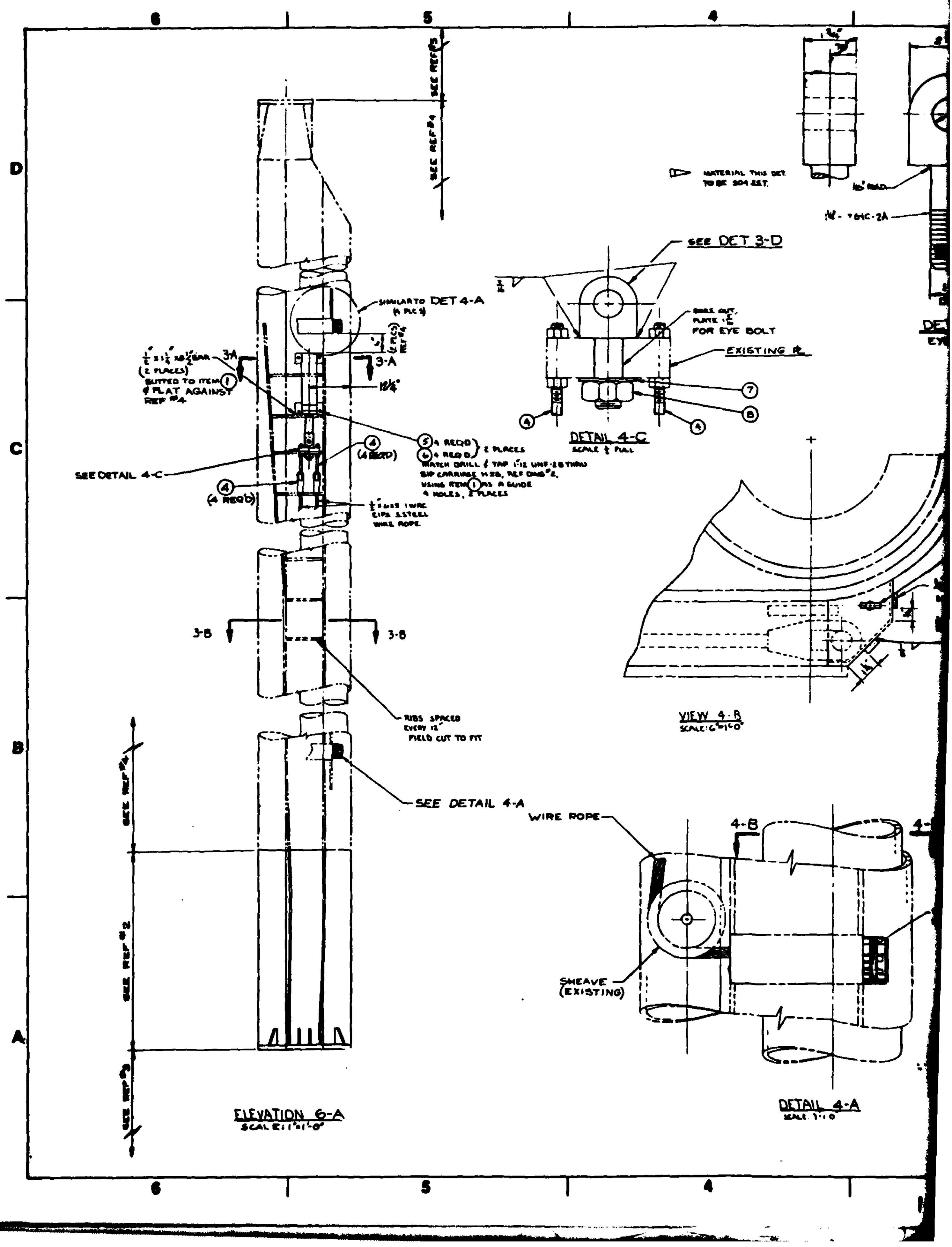
DETAIL 8-A
SCALE: 3"=1'-0"
(SEE SECT. 8-C)

11-C

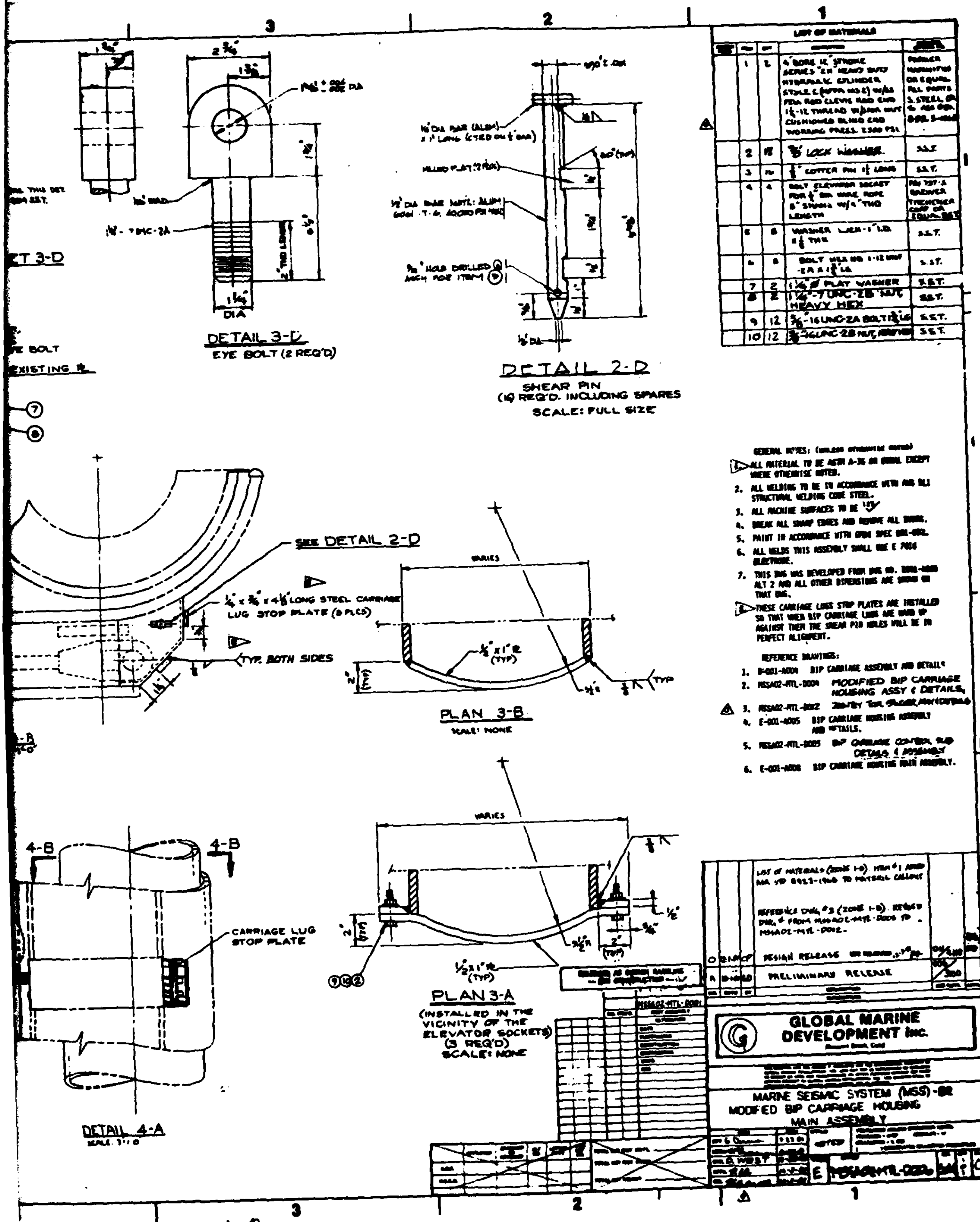
GLOBAL MARINE DEVELOPMENT Inc.

MARINE SEISMIC SYSTEM (MSS)
MODIFIED BIP CARRIAGE HOUSING
ASSEMBLY AND DETAILS

AS NOTED | E | 0



6
5
4
D
C
B
A
SEE REF #5
SEE REF #4
MATERIAL THIS DET. TO BE 304 SST.
SEE DET 3-D
SIMILAR TO DET 4-A
(4 PLCS)
BORE OUT PLATE
FOR EYE BOLT
EXISTING ℄
3-A
BUTTED TO ITEM 1
PLAT AGAINST REF #4
4 (4 REQ'D)
5 4 REQ'D
6 4 REQ'D
2 PLACES
USING ITEM 1 AS A GUIDE
4 HOLES, 2 PLACES
SEE DETAIL 4-C
DETAIL 4-C
SCALE ½ FULL
3-B
RIBS SPACED EVERY 12"
FIELD CUT TO FIT
VIEW 4-B
SCALE: 6"=1'-0"
SEE DETAIL 4-A
WIRE ROPE
4-B
SHEAVE
(EXISTING)
SEE REF #2
SEE REF #3
ELEVATION 6-A
SCALE: 1"=1'-0"
DETAIL 4-A



			LIST OF MATERIALS	
	1	2	4" BORE 12" STROKE SERIES "2H" HEAVY DUTY HYDRAULIC CYLINDER STYLE C (NFPA MS2) W/AS FEM. ROD CLEVIS ROD END 1¼-12 THREAD W/JAM NUT CUSHIONED BLIND END WORKING PRESS. 2500 PSI	PARKER HANNIFIN OR EQUAL. ALL PARTS S. STEEL [illegible]
	2	16	⅝" LOCK WASHER.	S.S.T.
	3	16	⅛" COTTER PIN 1½ LONG	S.S.T.
	4	4	BOLT ELEVATOR SOCKET FOR ⅞" DIA WIRE ROPE 8" SHANK W/4" THD LENGTH	[illegible] BREWER TRENCHER CORP OR EQUAL S.S.T.
	5	8	WASHER LOCK 1" I.D. × ⅛ THK	S.S.T.
	6	8	BOLT HEX HD 1-12 UNF -2A × 1½ LG	S.S.T.
	7	2	1¼" Ø FLAT WASHER	S.S.T.
	8	2	1¼"-7 UNC-2B NUT HEAVY HEX	S.S.T.
	9	12	⅝"-16 UNC-2A BOLT 1⅞ LG	S.S.T.
	10	12	⅝"-16 UNC-2B NUT, [illegible]	S.S.T.

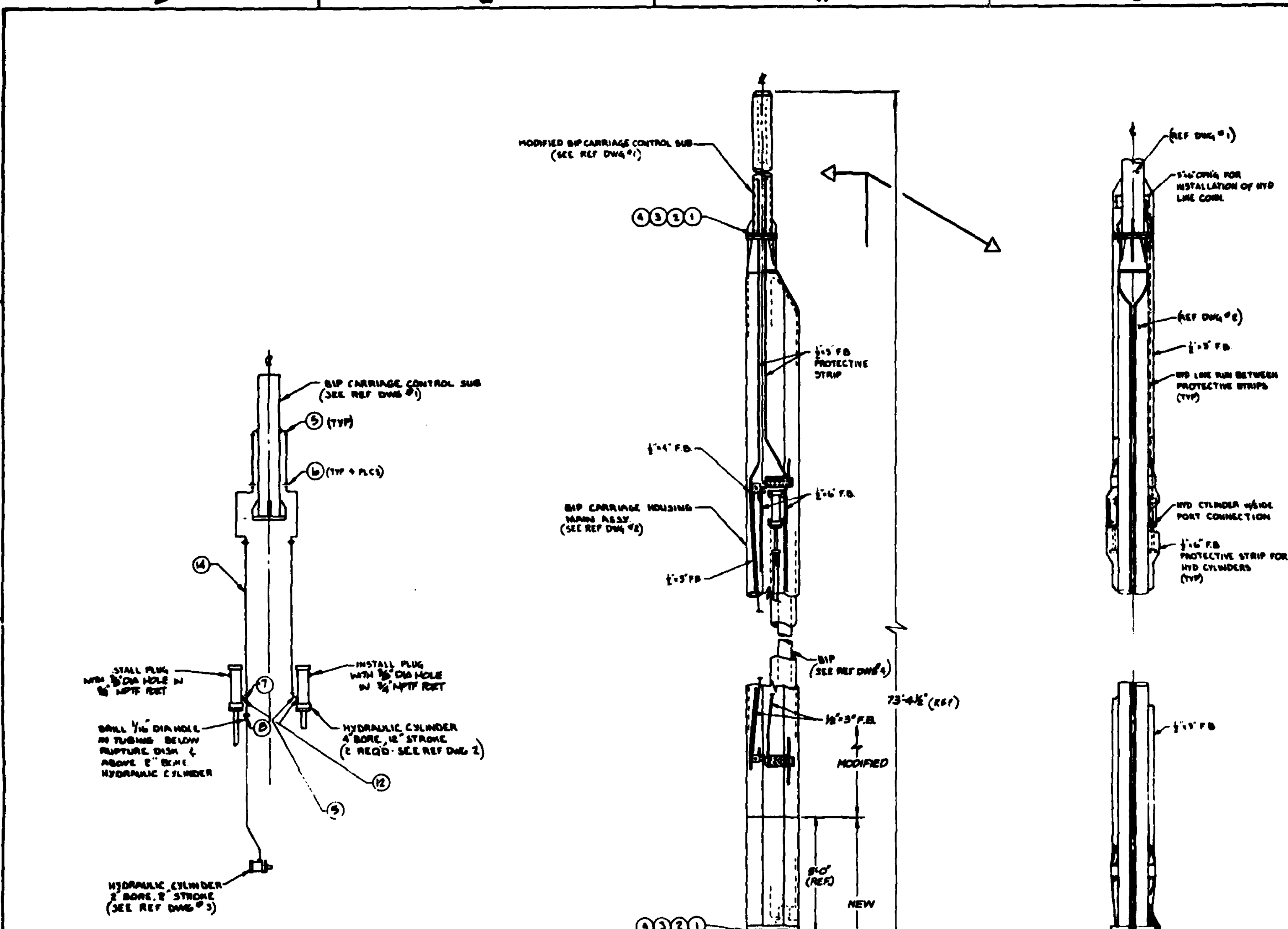
GENERAL NOTES: (UNLESS OTHERWISE NOTED)

1. ALL MATERIAL TO BE ASTM A-36 OR EQUAL EXCEPT WHERE OTHERWISE NOTED.
2. ALL WELDING TO BE IN ACCORDANCE WITH AWS D1.1 STRUCTURAL WELDING CODE STEEL.
3. ALL MACHINE SURFACES TO BE 125✓
4. BREAK ALL SHARP EDGES AND REMOVE ALL BURRS.
5. PAINT IN ACCORDANCE WITH GMDI SPEC 001-002.
6. ALL WELDS THIS ASSEMBLY SHALL USE E 7018 ELECTRODE.
7. THIS DWG WAS DEVELOPED FROM DWG NO. [illegible] ALT 2 AND ALL OTHER DIMENSIONS ARE SHOWN ON THAT DWG.
8. THESE CARRIAGE LUGS STOP PLATES ARE INSTALLED SO THAT WHEN BIP CARRIAGE LUGS ARE HARD UP AGAINST THEM THE SHEAR PIN HOLES WILL BE IN PERFECT ALIGNMENT.

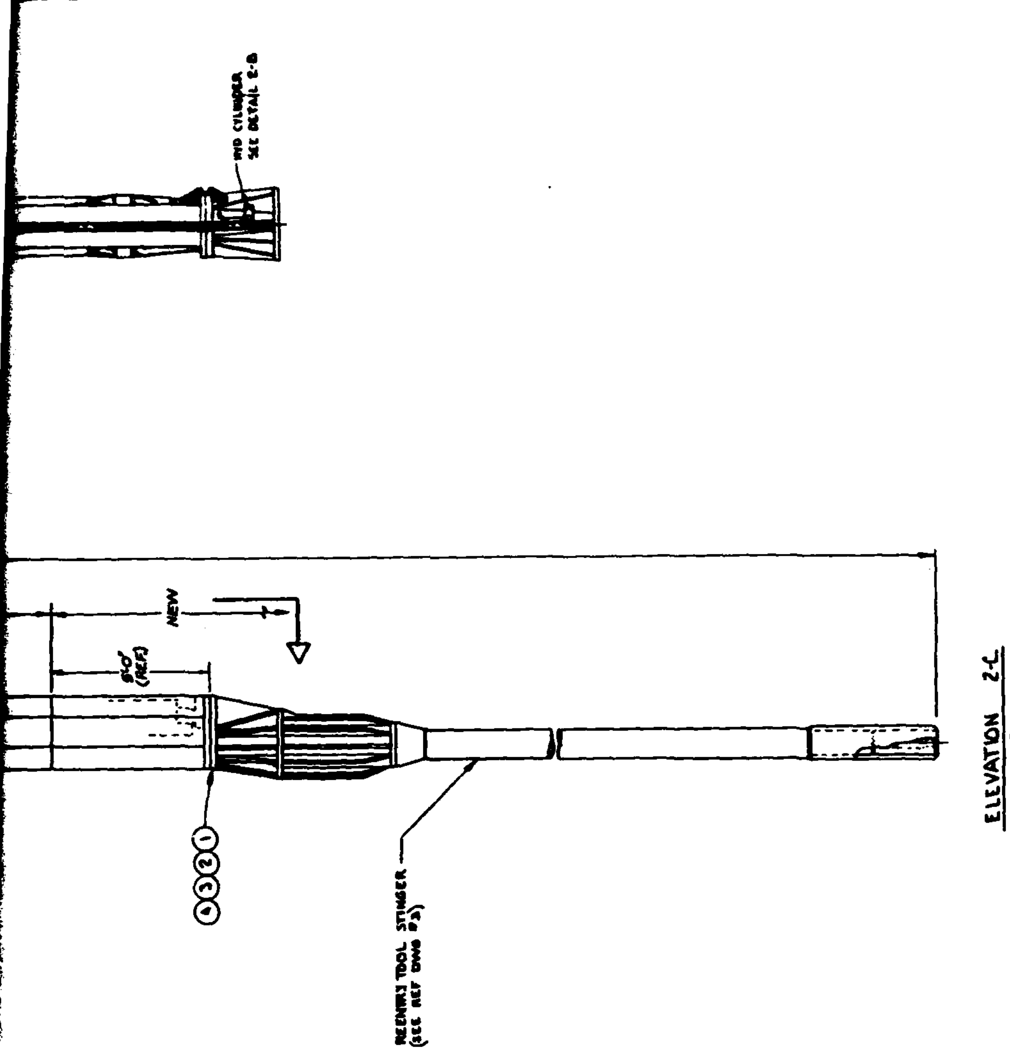
REFERENCE DRAWINGS:

1. D-001-A004 BIP CARRIAGE ASSEMBLY AND DETAILS
2. MSSA02-MTL-D004 MODIFIED BIP CARRIAGE HOUSING ASSY & DETAILS.
3. MSSA02-MTL-D002 [illegible]
4. E-001-A005 BIP CARRIAGE HOUSING ASSEMBLY AND DETAILS.
5. MSSA02-MTL-D005 BIP CARRIAGE CONTROL [illegible] DETAILS & ASSEMBLY
6. E-001-A008 BIP CARRIAGE HOUSING MAIN ASSEMBLY.

12



HYDRAULIC SCHEMATIC
N.T.S.



			LIST OF MATERIALS	
	1	24	3/8"-16UNF 2A ... LG CORROSION RESISTANT BLT	ASTM A ... TYPE 3
	2	24	3/8" PLAIN WASHER	SST
	3	24	3/8" LOCK WASHER	SST
	4	24	3/8"-16 UNF 2B CORROSION RESISTING NUT	ASTM A ... TYPE 3
	5	2	[illegible] WORKING PRESS 3500 PSI	SST
	6	4	[illegible] WORKING PRESS 3500 PSI	
	7	1	[illegible] WORKING PRESS 3500 PSI (PARKER)	
	8	1	1/2" NPTF [illegible] SET AT 3500 PSI [illegible] CONTINENTAL OR EQ.	
	9	2	NIPPLE 1/2" NPTF [illegible] TEE, WORKING PRESS 3500 PSI	
	10	1	1/2" NPTF PLUG	
△	11	1	1/2" NPTF TEE 3500 PSI	
△	12	3	1/2" NPTF - 1/2" NPTF BUSHING	
	13	1	PARKER [illegible] CONNECTOR [illegible] WORKING PRESS 3500 PSI	
△	14		1/2" X .065 SEAMLESS TUBING 18-8 TYPE 304	S. ST. ASTM A450 -79
	15	1	1/2" NPTF INLINE CHECK VALVE CRACKING PRESS 7.4 PSI, MILLER MODEL C-9, WORKING PRESS 3500 PSI	S. ST.

GENERAL NOTES: (UNLESS OTHERWISE NOTED)

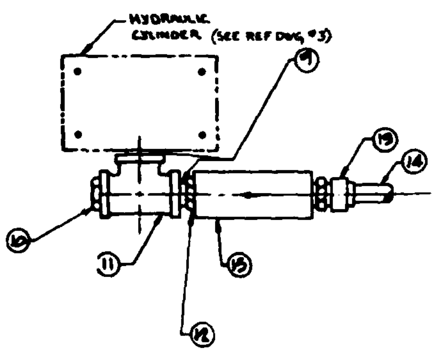
1. ALL TUBE FITTINGS ARE JIC 37½° FLAIR TYPE DESCRIPTION IS PER PARKER HANNIFIN'S CATALOG 4300, SEPT 1980, INDUSTRIAL TUBE FITTINGS.
2. HYDRAULIC TUBING RUN TO BE DETERMINED BY MANUFACTURE.
3. THIS DWG IS MODIFIED AND WAS DEVELOPED FROM DWG NO. E-001-N005 PLT 1.
4. HYDRAULIC TUBING & WIRE ROPES ARE TO BE ROUTED WITHIN THE BOUNDRIES OF THE PROTECTIVE STRIPS AS SHOWN TO GIVE MAXIMUM PROTECTION FROM DAMAGE.
5. VENT PORTS OF CYLINDERS ARE TO BE COVERED WITH ADHESIVE TAPE DURING ASSEMBLY AND AFTER TEST.
6. ALL BOLTS TO BE TACK WELDED ON FINAL ASSEMBLY.
7. ALL HYDRAULIC PIPING SHALL BE ADEQUATELY STAYED & SUPPORTED.
8. BEND RADIUS OF TUBING SHALL NOT BE LESS THAN 5 TIMES THE DIAMETER OF THE TUBING.

REFERENCE DWGS:

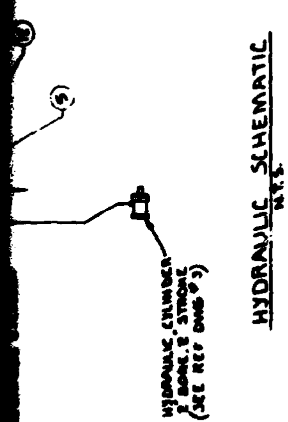
1. MSSA02-MTL-D003 BIP CARRIAGE CONTROL SUB DETAILS & ASSEMBLY
2. MSSA02-MTL-D006 MODIFIED BIP CARRIAGE HOUSING, MAIN ASSEMBLY
3. MSSA02-MTL-D012 REENTRY TOOL STINGER ASSEMBLY AND DETAILS

TELEDYNE GEOTECH DWGS:

4. 990-53100 BIP



DETAIL 2-B
N.T.S.



HYDRAULIC SCHEMATIC
N.T.S.

REVISED ITEM 8, WAS 3000 PSI TO 3500 PSI ZONE 1-D.
REVISED ITEM 14, REMOVED ... FROM ... CALLOUT & CHANGED ... FROM ... TO ... ASTM A450-79, ZONE 1-C.
REVISED REF DWG #3 FROM ... TO MSSA02-MTL-D012, ZONE 1-B.
ADDED 3500 PSI TO ITEM 12 DESCRIPTION.

0 DESIGN RELEASE
A PRELIMINARY RELEASE

RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

MSSA02-MTL-D001

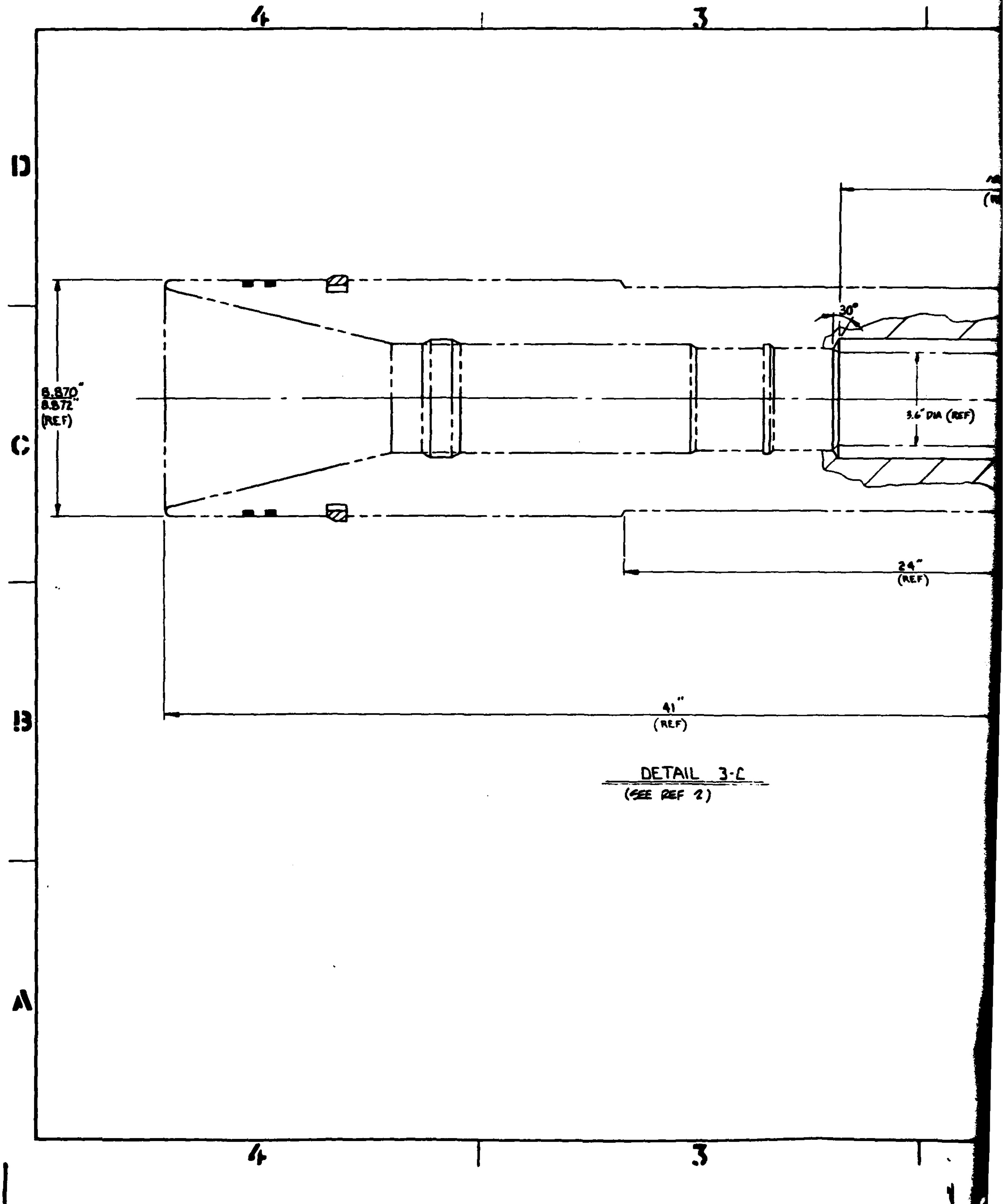
GLOBAL MARINE DEVELOPMENT Inc.

MARINE SEISMIC SYSTEM (MSS)-02
MODIFIED BIP REENTRY SUB ASSEMBLY

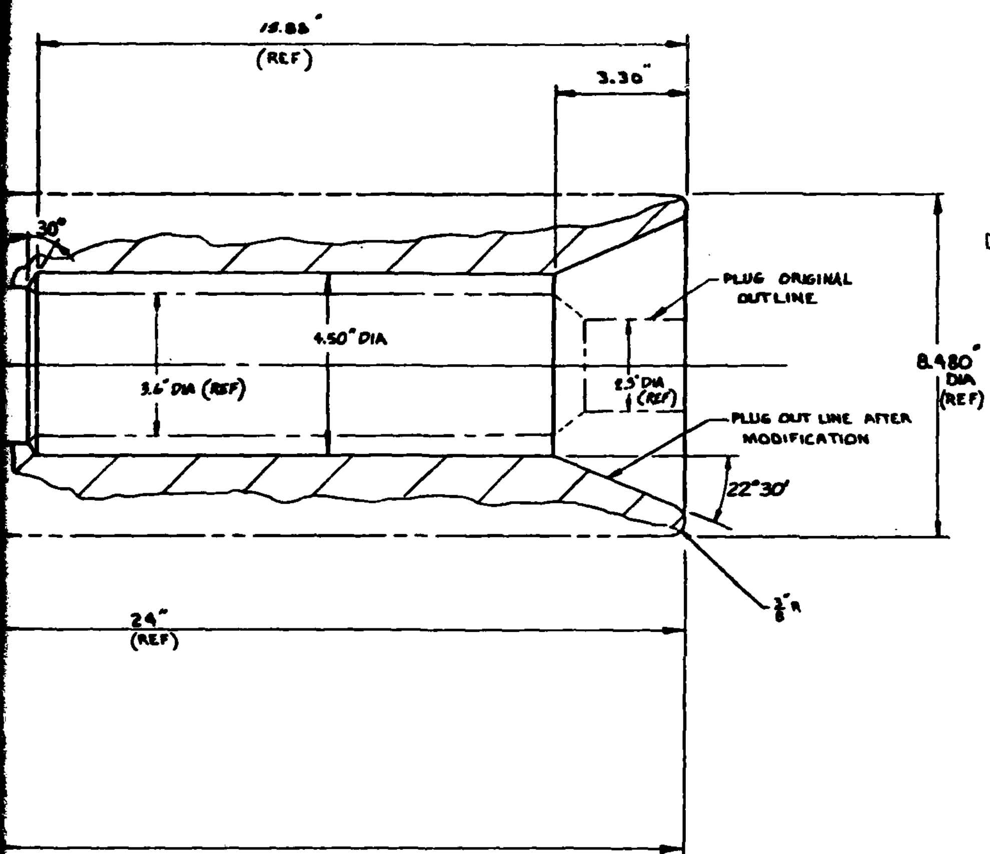
NOTED

E MSSA02-MTL-D001

12



4
3
D
C
B
A
8.870"
8.872"
(REF)
30°
3.6" DIA (REF)
24"
(REF)
41"
(REF)
DETAIL 3-C
(SEE REF 2)



LIST OF MATERIALS

GENERAL NOTES: (UNLESS OTHERWISE NOTED)

1. DIAMETER TO BE CONCENTRIC TO .030 TIR
2. BREAK ALL MACHINE CORNERS & RADII TO 0.01" MIN
3. ALL MACHINE SURFACES TO 125
4. MACHINE TOLERANCES TO BE .X ± .1, .XX ± .05, .XXX ± .010
5. PLUG TO BE MODIFIED AS SHOWN AND SECURED IN POSITION AS SHOWN ON REF 1.
6. ONE PLUG TO BE MODIFIED.
7. THIS DWG WAS DEVELOPED FROM REF. 2. DIMENSIONS NOT SHOWN ON THIS DWG ARE SHOWN ON REF. 2. DIM'S CODED (REF) ARE EXISTING.
8. PLUG MATERIAL AISI 4140.

REFERENCE DWGS:

1. MSSA02-MTL-D003 — BIP CARRIAGE CONTROL SUB DETAILS & ASSEMBLY
2. D-001-A010 — MSS HYDR PLUG/SONAR ADAPTER DETAILS

O	12-1-81	KP	DESIGN RELEASE	011/4110
A	9-21-81	GD	PRELIMINARY RELEASE	004/3100

RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

MSSA02-MTL-D003

GLOBAL MARINE DEVELOPMENT Inc.
Newport Beach, Calif.

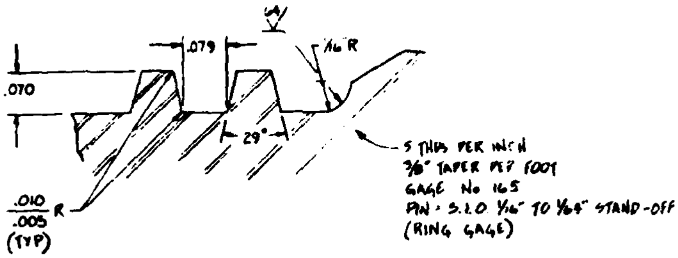
MARINE SEISMIC SYSTEM (MSS) - 82
HYDRAULIC PLUG/SONAR ADAPTER MODIFICATION

DFT. G. Donovan	9-17-81	HALF SIZE
D. WEST	10-23-81	
RCG	11-2-81	
RCG	12-1-81	

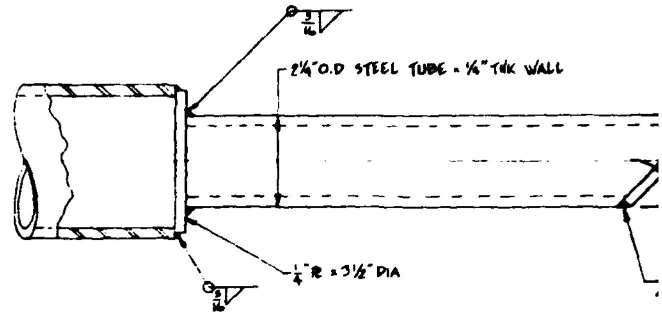
D MSSA02-MTL-D008 541 1 of 1 O

2

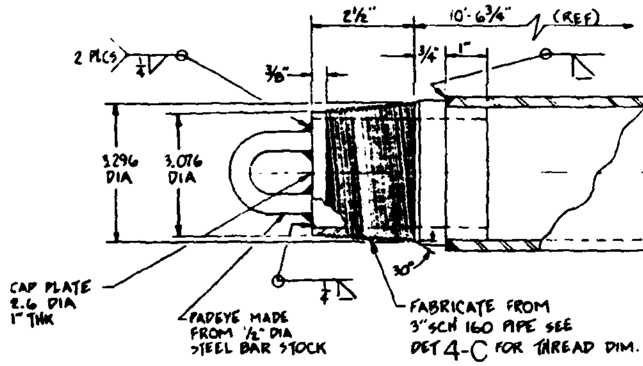
1 2



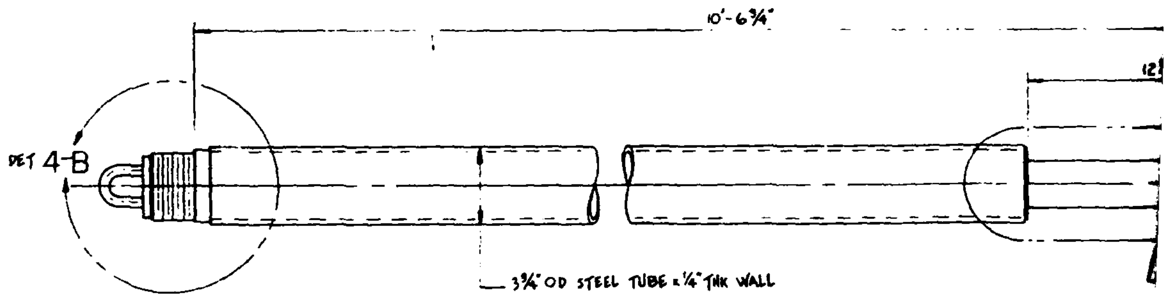
DETAIL 4-C
NTS
(FROM VIEW 4-B)



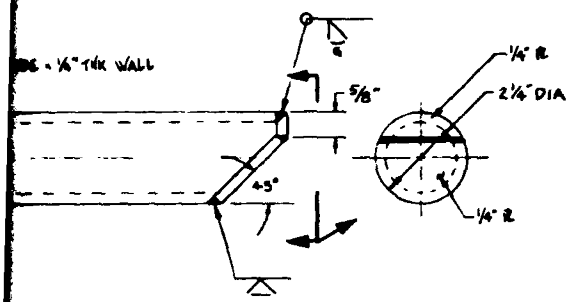
DETAIL 3-C
SCALE HALF SIZE
(FROM VIEW 3-B)



DETAIL 4-B
SCALE : HALF SIZE
(FROM VIEW 3-B)



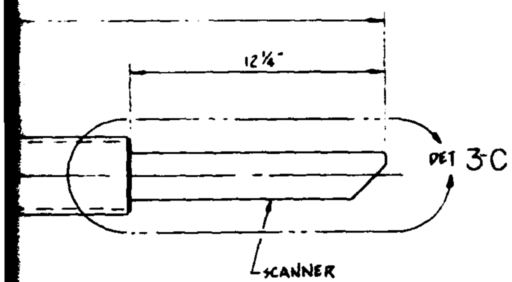
VIEW 3-B
DUMMY SONAR REENTRY TOOL
SCALE 3"=1'-0"



GENERAL NOTES:

1) COMPLETED SONAR REENTRY TOOL SHOULD WEIGH APPROX 230 LBS., FILL WITH SAND, SCRAP METAL, OR LEAD.

2) THE FOLLOWING DIMENSIONAL TOLERANCES SUPERCEDE TOLERANCES NOTED IN TITLE BLOCK AND ARE TO BE USED ON THIS PART.
.X = .X ± .1
.XX = .XX ± .03
.XXX = .XXX ± .010



NO.	DATE	BY	DESCRIPTION	JOB AUTH.	APPD.
0	12-28-81	RC	DESIGN RELEASE	011/4110	

ALTERATIONS

NEXT ASSEMBLY: MSSA02-MTL-D011

RELEASED AS DESIGN BAS. LINE — FOR CONSTRUCTION —

TOTAL NET WEIGHT 230 LBS

GLOBAL MARINE DEVELOPMENT INC.
Newport Beach, Calif.

MARINE SEISMIC SYSTEM (MSS-82)
DUMMY SONAR REENTRY TOOL

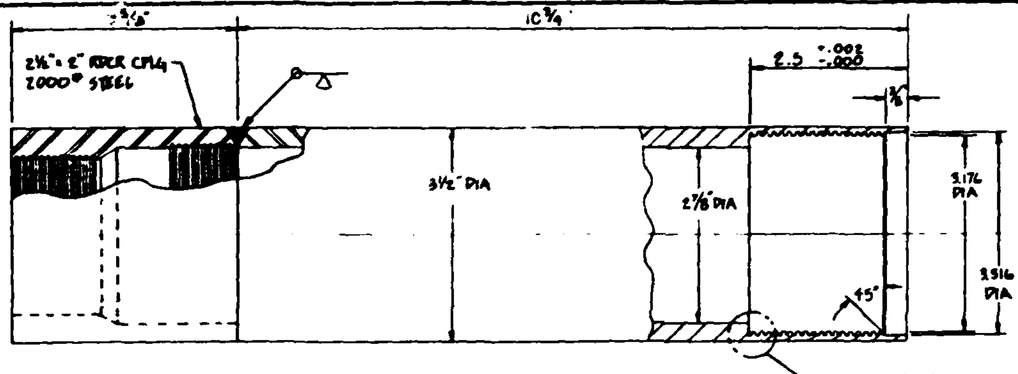
NAME	DATE
DFT R. J. BUDA	12-14-81
CHK P. PALMER	12-23-81

SCALE: NOTED

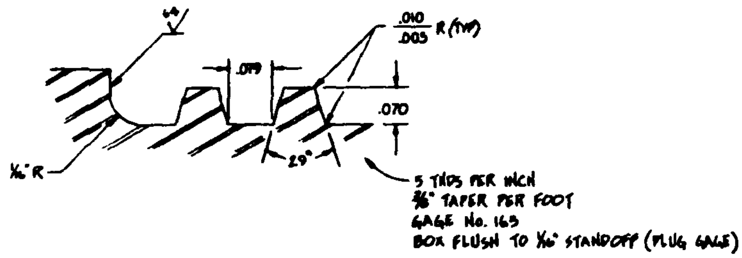
DWG SIZE: D

DWG NO. MSSA02-MTL-D009

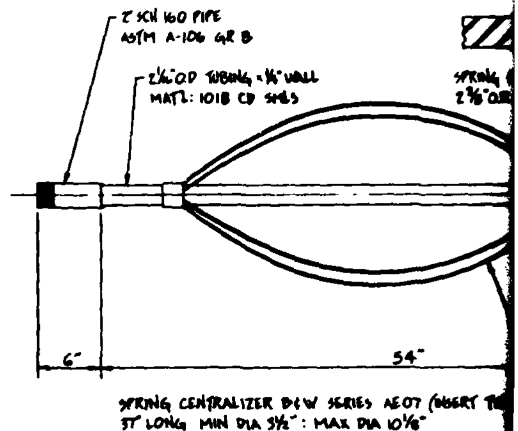
ALT 0



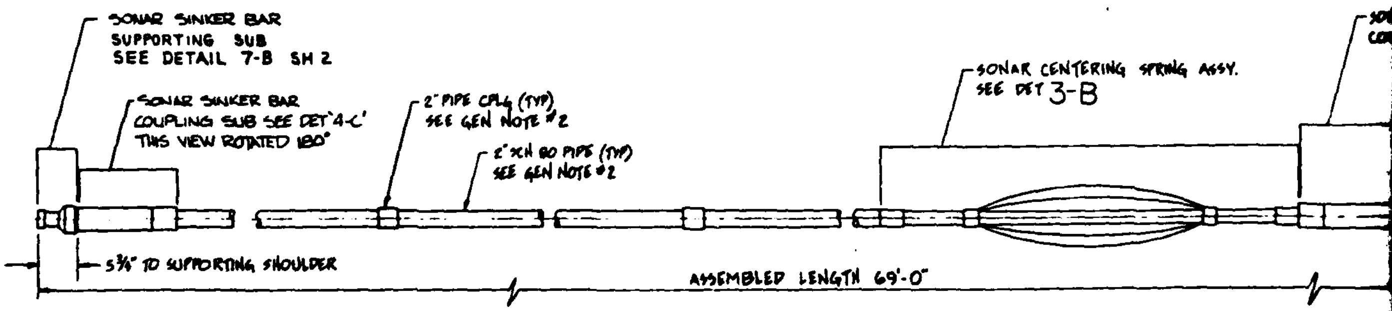
DETAIL 4-C
SONAR SINKER BAR COUPLING SUB
N.T.S.
(FROM VIEW 3-A)



DETAIL 4-B
N.T.S.
(FROM VIEW 4-C)



DETAIL 3-B
SONAR CENTERING SPRING ASSY
SCALE: 1 1/2" = 1'-0"
(FROM VIEW 3-A)



VIEW 3-A
SONAR AND SINKER BAR ASSEMBLY
N.T.S.

LIST OF MATERIALS

GENERAL NOTES:

1) FINISH ▽ EXCEPT WHERE NOTED.

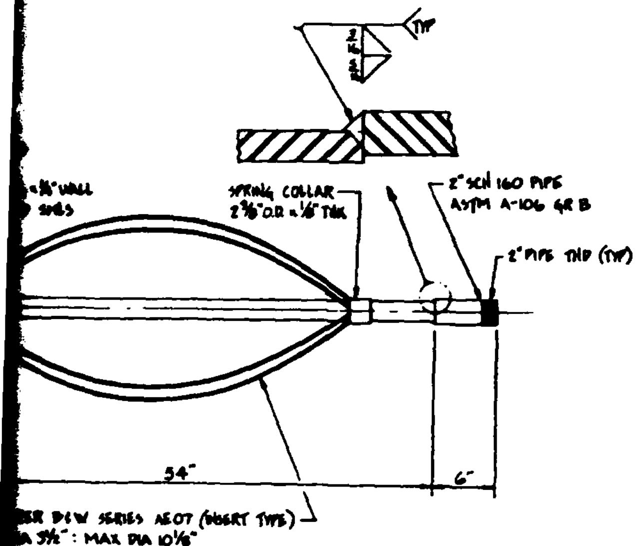
2) SUFFICIENT PIPE LENGTHS AND COUPLINGS SHALL BE SUPPLIED TO MAKE UP ASSEMBLED LENGTH.

3) THE FOLLOWING DIMENSIONAL TOLERANCES SUPERCEDE TOLERANCES NOTED IN TITLE BLOCK AND ARE TO BE USED ON THIS PART.
.X = .X ± .1
.XX = .XX ± .03
.XXX = .XXX ± .010

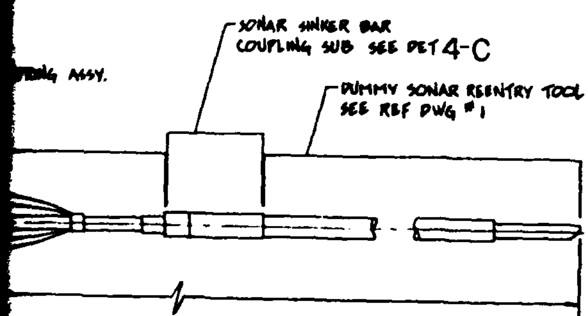
4) BREAK ALL SHARP CORNERS .063 UNLESS OTHERWISE NOTED.

REFERENCE DWGS:

1. MSSA02-MTL-D009 MARINE SEISMIC SYSTEM (MSS-82) DUMMY SONAR REENTRY TOOL



DETAIL 3-B
SONAR CENTERING SPRING ASSY
SCALE: 1 1/2" = 1'-0"
(FROM VIEW 3-A)



RELEASED AS DESIGN BASELINE — FOR CONSTRUCTION —

TOP ASSY

0	12-28-81		DESIGN RELEASE

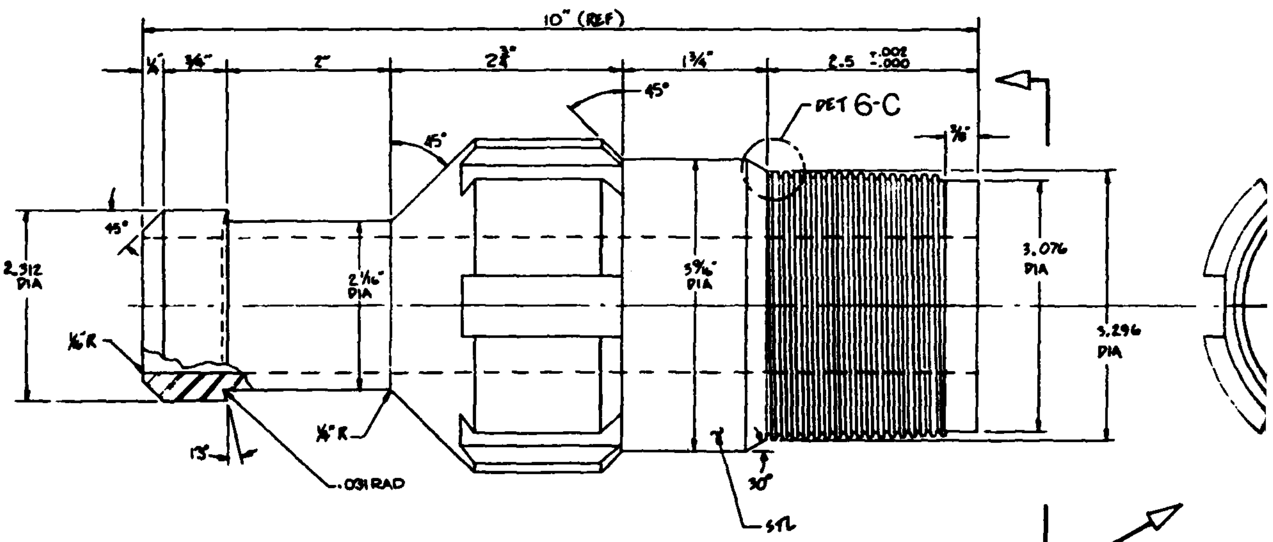
GLOBAL MARINE DEVELOPMENT Inc.
Newport Beach, Calif.

MARINE SEISMIC SYSTEM (MSS-82)
SONAR SINKER BAR
ASSEMBLY AND DETAILS

DR. R. J. BUDA 12-14-81
P. PALMER 12-28-81
SCALE NOTED
D MSSAC2-MTL-D011 0

2 1

1 2



DETAIL 7-B

SONAR SINKER BAR SUPPORTING SUB

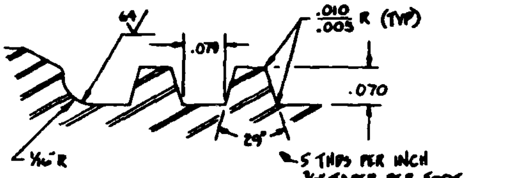
SCALE: FULL SIZE

1 REQ'D PER ASSY

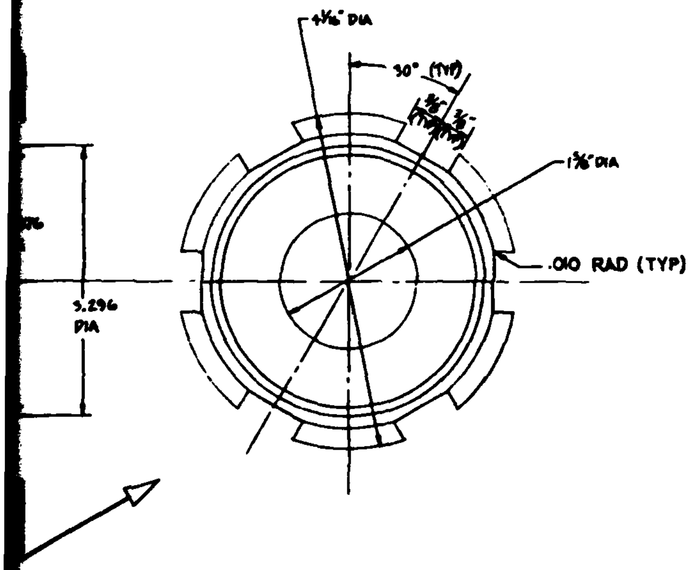
MATERIAL: 4130 HT TR BHN 223-235

(FROM VIEW 3-A)

LIST OF MATERIALS



DETAIL 6-C
N.T.S
(FROM VIEW 7-B)



RELEASED AS DESIGN BASELINE
— FOR CONSTRUCTION —

NO.	DATE	BY	DESCRIPTION	JOB APVL
0	12-28-81	RJB	SEE SH 1 FOR NOTES AND ALTERATIONS	011/4110

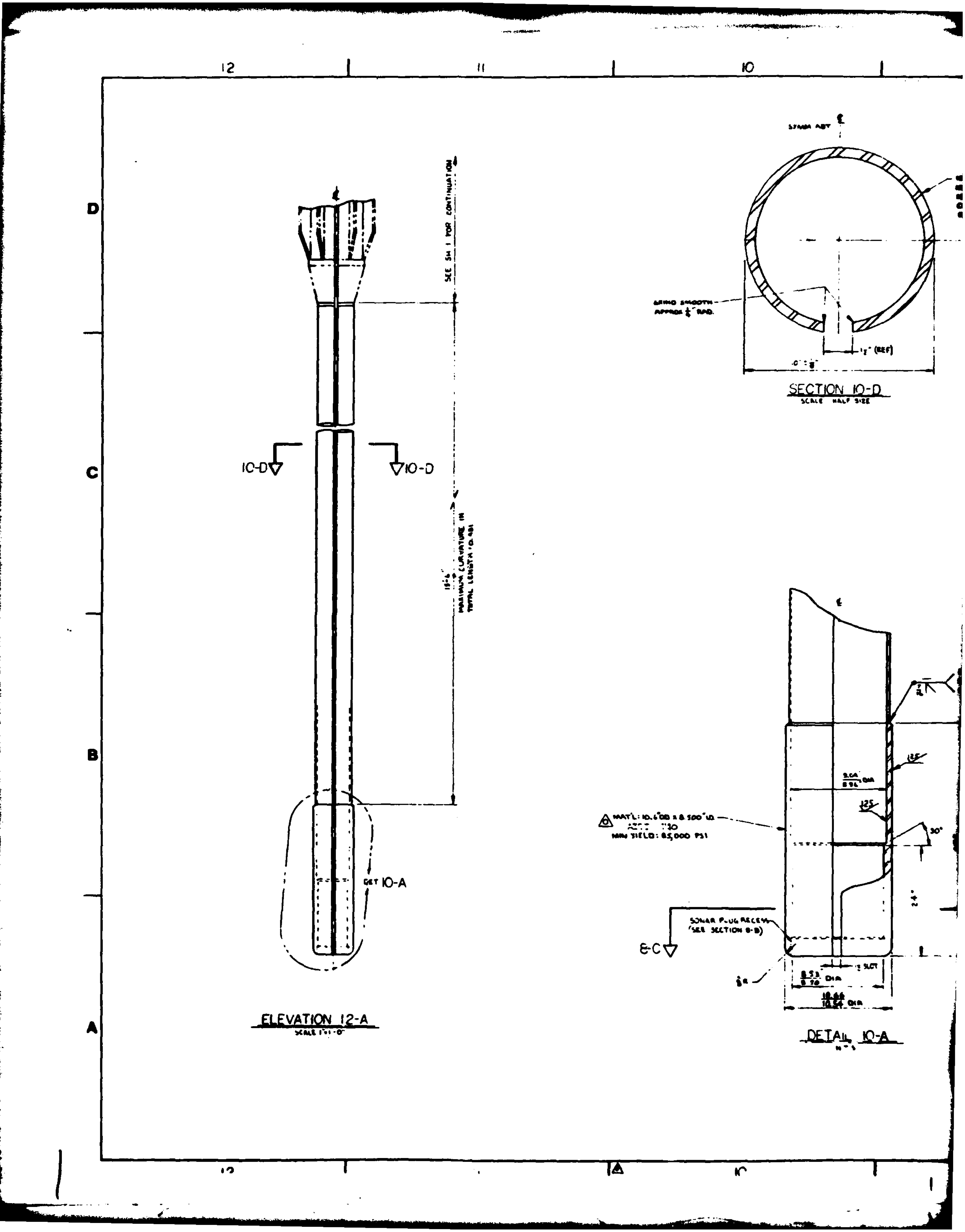
GLOBAL MARINE DEVELOPMENT INC.
Newport Beach, Calif.

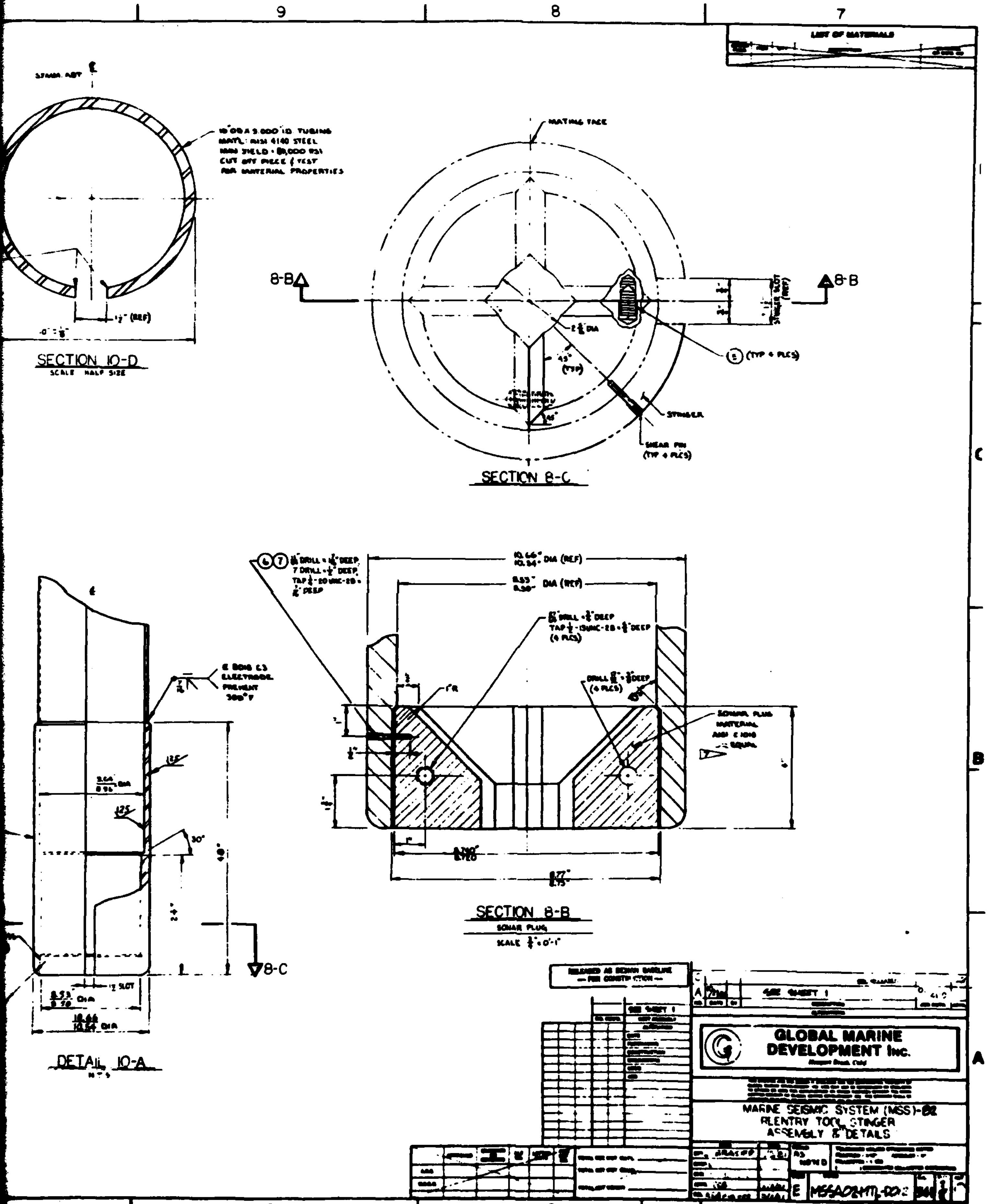
MARINE SEISMIC SYSTEM (MSS-82)
SONAR SINKER BAR
ASSEMBLY AND DETAILS

R. J BUDA	12-19-81	
W. Buchanan	12-23-81	
P. PALMER	12-22-81	

SCALE: NOTED

DWG SIZE: D — DWG NO. MSSA02-MTL-D011 — C.C. 541 — SHT. 2 OF 2 — ALT. 0


12
11
10
D
C
B
A
SEE SH 1 FOR CONTINUATION
10-D
10-D
DET 10-A
ELEVATION 12-A
SECTION 10-D
SCALE HALF SIZE
GRIND SMOOTH
$1\frac{1}{2}$" (REF)
MAT'L: 10.500 OD x 8.500 ID
MIN YIELD: 85,000 PSI
SONAR PLUG RECESS
(SEE SECTION 8-B)
8-C
30°
DETAIL 10-A



LIST OF MATERIALS
MATING FACE
8-B
SECTION 10-D
SCALE HALF SIZE
STINGER
SHEAR PIN (TYP 4 PLCS)
SECTION 8-C
SECTION 8-B
SONAR PLUG
8-C
DETAIL 10-A
GLOBAL MARINE DEVELOPMENT Inc.
MARINE SEISMIC SYSTEM (MSS)-B2
REENTRY TOOL STINGER
ASSEMBLY & DETAILS

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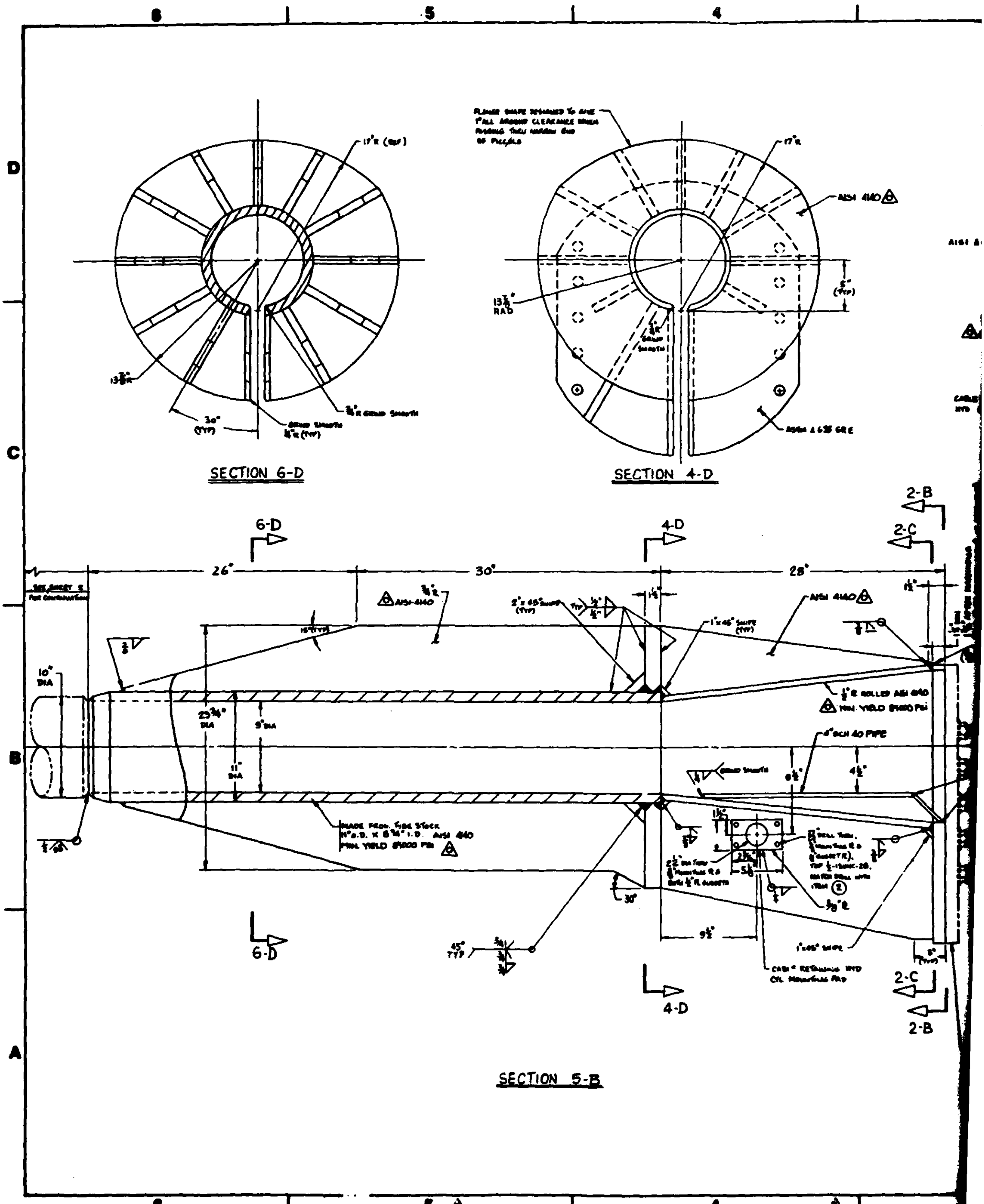
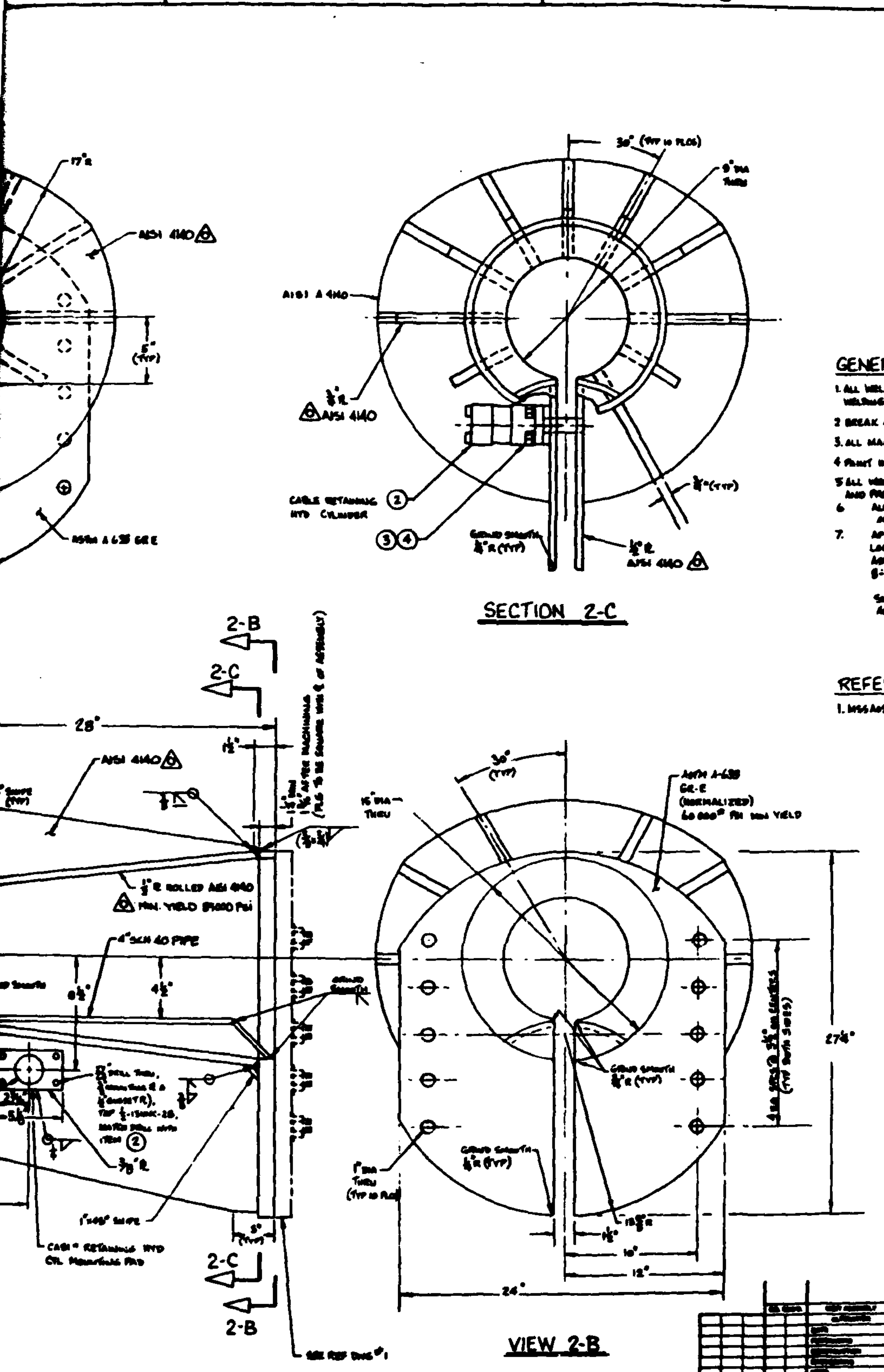

SECTION 6-D
SECTION 4-D
SECTION 5-B
6-D
4-D
2-B
2-C
26"
30"
28"
AISI 4140
10" DIA
5" DIA
11" DIA
4" SCH 40 PIPE
MIN. YIELD
30°
45° TYP
13 7/8" RAD
17"R
D
C
B
A
6
5
4



LIST OF MATERIALS

ITEM	QTY	DESCRIPTION	
1		NOT USED	
2	1	HYD CYLINDER [illegible]	[illegible]
3	4	[illegible]	[illegible]
4	4	[illegible] LOCK WASHER	[illegible]
5		NOT USED	
6	4	[illegible] DIA x 1" LONG PIN	[illegible]
7	4	[illegible] SOCKET HEAD FLAT POINT SET SCREW SELF LOCKING	[illegible]

GENERAL NOTES:

1. ALL WELDING IS TO BE IN ACCORDANCE WITH AWS D1.1-79 STRUCTURAL WELDING CODE - STEEL.
2. BREAK ALL SHARP EDGES AND REMOVE BURRS.
3. ALL MACHINE SURFACES TO BE [illegible]
4. PAINT IN ACCORDANCE WITH ENGR. SPEC. 001-[illegible]
5. ALL WELDS THIS ASSEMBLY ARE TO BE WELDED WITH E [illegible] AND PRE-HEAT @ 175°F
6. ALL INTERNAL DIAMETERS ARE TO BE CONCENTRIC TO WITHIN .003" OF AN INCH
7. AFTER TURNING SONAR PLUG, CUT INTO 4 SECTIONS, DRILL FOR LOCATING GUIDE PINS, INSTALL GUIDE PINS THEN PLACE ASSEMBLED PLUG IN STINGER AND ALIGN AS SHOWN IN SECTION 2-C AFTER WHICH THE HOLES FOR SHEAR PINS ARE INSTALLED. THE MATERIAL REMOVED WHEN CUTTING INTO 4 SECTIONS SHOULD BE COMPENSATED FOR BY BRAZING HIGH SPOTS AND FILING.

REFERENCE DWG'S:

1. MSSA02-MTL-D004 MODIFIED BOP CARRIAGE HOUSING ASSEMBLY AND DETAILS

LIST OF MATERIALS ITEM 2 (ZONE 1-D, SH1) ADDED DIA 895-3-1965 TO PARTS DESCRIPTION.

REVISED MATERIAL SPECS IN SECTION 6-B (ZONE 4-B (5D, SH 1), SECTION 2-C (ZONE 2-C, SH1) AND SECTION 4-D (ZONE 4-D, SH1) FROM ASTM A572-67 TO AISI 4140 AND ADDED NOTE OF MIN YIELD OF 85000 PSI IN SECTION 5-B. DETAIL 10-A (ZONE 10-A, SH 2 OF 2) CHANGED MATERIAL SPEC FROM ASTM A543 CL [illegible] TO AISI 4140.

DESIGN RELEASE

A PRELIMINARY RELEASE

GLOBAL MARINE DEVELOPMENT Inc.

MARINE SEISMIC SYSTEM (MSS)-B2
REENTRY SUB STINGER
ASSEMBLY AND DETAILS

SCALE 3"=1'-0"

E MSSA02-MTL-D012

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